FALL PREVENTION AMONG OLDER ADULTS:

A QUANTITATIVE AND QUALITATIVE STUDY

By:

Megan Cummings

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ABSTRACT

The purpose of this study was to investigate the effect of a fall prevention program on older adults as well as to explore the perceptions of older adults have on fall risk and the fall prevention program. This research was completed in Newfoundland and Labrador, Canada with participants above the age of 65. The 10-week fall prevention program focused on balance, strength, and flexibility and was followed by focus groups with the control and intervention groups. Pre and post-test measures (postural sway, TUG test, foam and dome test, ABC Scale, ESE Scale, FES Scale, SAFFE) were completed to determine if the fall prevention program decreased fall risk. The results of the quantitative portion of the study did not produce significant results however the qualitative portion was very informative. Five themes emerged from the focus group data: risk factor awareness, confidence, connectedness, quality of life, and program promotion. This research highlights the importance of fall prevention programs for older adults, not only to keep them healthy, but also for the personal and social benefits they facilitate.

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CHAPTER ONE
INTRODUCTION

Lord, Sherrington, & Menz (1996) defined a fall as an event that resulted in a person coming to rest unintentionally on the ground or lower level not as a result of a syncopal event, other major intrinsic event, or an overwhelming hazard. For individuals over the age of 65 years falls are a major problem. Approximately 20-30% of older adults fall each year and falls are the leading cause of injury-related hospitalizations among older adults in Canada (Public Health Agency of Canada, 2014). In 2011, an estimated 5 million Canadians, or 15% of the population, were 65 years of age or older (Statistics Canada, 2011). This number is expected to double in the next 25 years and reach 10.47 million older adults by 2036 (Public Health Agency of Canada, 2014). As the age of the population increases so will the number of falls.

A fall can have many negative physical and mental consequences for older adults. The most common consequence of a fall is moderate to severe injuries such as lacerations, bone fractures, and head trauma (Centers for Disease Control and Prevention (CDC), 2015). As people age, muscles and bones deteriorate leaving older adults susceptible to injury when they fall (Maki and McIlroy, 1996). A fall can result in death with fall related mortality rates increasing by 65% from 2003 to 2008 (Public Health Agency of Canada, 2014). Falls are also often the catalyst for an older adult's transition into a long-term care facility (Public Health Agency of Canada, 2014), which means a loss of independence. An emotional consequence of falling is developing a fear of falling. Once an older adult develops this fear, it is likely that activity restriction will occur which can lead to isolation from family and friends as well as a loss of independence (Public Health Agency of Canada, 2014). Activity restriction can lead to reduced mobility and a loss of physical

capabilities, which in turn increases the risk of falling (CDC, 2015). In addition to the individual consequences of falling, there is also the financial burden to society. As fall rates increase so do health care costs, resulting in significant financial and resource strains on the health care system. According to the Public Agency of Canada (2014) the direct costs associated with falls among older adults in Canada were estimated at over $2 billion in 2004; as the population ages, this figure will continue to rise.

According to Veterans Affairs Canada (2015), falls are the most preventable health risk for older adults. Health, physical activity levels, lifestyle choices, and home modifications can all play a role in fall prevention (Veterans Affairs Canada, 2015). There has been considerable research on the benefits of exercise based fall prevention programs for older adults such as improved balance, strength, and a reduction of environmental risk factors (e.g., Barnett, 2004; Lee, Chang, Tsauo et al., 2013; Shumway-Cook, Silver, LeMier et al., 2007; Williams & Ullmann, 2012). Health status is also important in preventing falls and reducing the risk of injury. To decrease the chance of a fall occurring older adults should follow a healthy diet, increase strength, and monitor balance, hearing, eyesight and medication (Veterans Affairs Canada, 2015).

Falls in older adults are particularly relevant to the province of Newfoundland and Labrador (NL) since its population is aging faster than any other province in Canada (Statistics Canada, 2014). Currently, the province does not have a provincial fall prevention strategy in place. To help ensure that NL seniors avoid falls and remain independent for as long as possible it is important for NL to develop an effective fall prevention strategy. There are two components required to ensure this outcome. One is to design an effective program that is based on research of previously successful programs. The other component

is to design a program that older adults will want to participate in. A program that cannot attract older adults to participate will not be successful. In order to help ensure they participate in such a program it would seem to make sense that older adults must have an appreciation for the importance of fall prevention and see the relevance of such a program to them. In so doing they will be more likely to attend and adhere to the program. In order to help increase older adults' participation in fall prevention programming, understanding the views and perceptions of older adults with respect to fall prevention and fall prevention programming would be useful. There is little to no research on the views of NL older adults on fall prevention programs or fall risk. Although research done in the United Kingdom (Yardley, Donovan-Hall, Francis et al., 2006) and Australia (Haines, Day, Hill, et al., 2014) does offer some insight, data gathered from older adults in NL would be invaluable to researchers and consultants involved in fall prevention program design within the province. Such research would help develop a better understanding of how older adults in NL perceive their fall risk and fall prevention programs in general. This study is designed to examine this issue. There is significance to this study since it is one of a very few studies that used a mixed methodology design, an experimental design with both objective and subjective measures as well as qualitative focus groups, to investigate fall prevention in older adults. As such the purposes of this research were:

1) To identify the views and opinions of older adults of the province of NL as they relate to their personal fall risks and fall prevention programming in general.
2) To examine how older adults in a rural NL community perceive their experiences in a 10-week fall prevention program.

CHAPTER TWO
LITERATURE REVIEW

As outlined in the previous chapter, falls in older adults can have serious and life altering consequences. Fall prevention in this population is key to ensure that older adults can lead healthy, productive, and independent lives for as long as possible. In order for fall prevention intervention to be effective it must take into consideration the factors that contribute to increased fall risk and also ensure it meets the needs of the older adults it is targeting. The literature review that follows provides a detailed review of both the intrinsic and extrinsic factors that have been shown to increase falls risk. There are many factors that may contribute to a fall. In order for fall prevention programing to be successful, older adults must first want to attend the program and later adhere to the program. Factors that contribute to exercise adherence include exercise self-efficacy, quality of life, and social support. As such a brief review of these areas is also included. Lastly, there has been little research around older adults perception of their own fall risk and participating in fall prevention programs. The review will conclude with an examination of the literature in this area.

THE EFFECTS OF AGING ON BALANCE

Approximately, one third of people over the age of 65 will experience a fall within a given year and over half of those will fall again the following year (Pérula, Varas-Fabra, Rodriguez et al., 2012). According to the Public Health Agency of Canada (2011), aging increases the likelihood that a fall-related injury will result in death with falls accounting for 20% of injury-related deaths among those over 65 years of age. Approximately half of falls occur in and around the fallers' own home (Pérula et al., 2012). Following a fall-related injury, older adults often experience substantial decrease in quality of life due to

physical and emotional suffering, hospitalization, transfers to extended care facilities, and the loss of an independent lifestyle (Yates & Dunnagen, 2001). Falls in older adults are responsible for 40% of long-term care admissions (Public Health Agency of Canada, 2011).

A fall can also result in tremendous social and psychological strain on the faller. Between 30% and 75% of older adults who have fallen once admit they are afraid to fall again (Pérula et al., 2012). Fear of falling can have a tremendous impact on the quality of life and physical decline of older adults (Yates & Dunnagen, 2001). Regardless of health status, fear of falling can lead to deterioration in perceived health status and can threaten social function which in turn effects quality of life (Brouwer, Walker, Rhdahl et al., 2003). A fear of falling can cause an older adult to limit their activities often resulting in a loss of strength and flexibility, which increases the chance of falling again (Public Health Agency of Canada, 2011). Given the high rate of falls in older adults and the serious implications falls have for this population, considerable research has been conducted in an effort to better understand why older adults fall more than younger individuals and also how best to prevent these falls.

FACTORS THAT CONTRIBUTE TO INCREASED FALL RISK IN OLDER ADULTS

Falling occurs due to an interaction between factors that are both extrinsic and intrinsic to the individual. Extrinsic factors, which are constraints of the environment or the task (Woollacott, 2000), are related to the surrounding environment and lifestyle factors such as ice, lack of lighting, and how activities of daily living are conducted (Shumway-cook, Gruber, Baldwin et al., 1997). Intrinsic factors, which are constraints within the individual (Woollacott, 2000), that increase the likelihood of a fall occurring are muscle

strength (Rubenstein, 2006), postural control (Rubenstein, 2006), and delay in APAs (Bleuse et al., 2006) which all contribute to poor balance. While both extrinsic and intrinsic factors are important contributors to falls risk, this research focuses almost exclusively on modifying intrinsic factors. As such these will now be reviewed in more detail.

The intrinsic factors listed above have all been identified in older adults and as such have received considerable attention from researchers in an effort to better understand why fall risk increases with age (Brouwer et al., 2003; Greenwood, Duffell, Alexander et al., 2011; Nitz & Choy, 2004; Shumway-cook, Brauer, Woollacott, 2000). The following sections will provide more details of literature related to intrinsic factors affecting falls in older adults.

INTRINSIC FACTORS THAT EFFECT FALLING IN OLDER ADULTS

Many researchers interested in better understanding why fall risk increases with age have investigated the effects of aging on postural sway during quiet standing (e.g., Allum, Carpenter, Honegger et al., 2002; Blaszczyk, Lowe, Hansen, 1994; Duncan, Weiner, Chandler et al., 1990; Horak, Shupert, Mirka, 1989; Maki & McIlroy, 1996). Studies have shown age-related decreases in the stability limits of the base of support (BOS) (Blaszczyk et al., 1994; Duncan et al., 1990). The stability limit is the range over which individuals can transfer their center of mass (COM) within their BOS (Blaszczyk et al., 1994). In a study done by Horak et al. (1989), older adults had a tendency to underestimate their true stability limits. They suggested that these results might indicate that older adults use inappropriate postural strategies due to perceiving stability limits to be smaller than they actually are. Despite this underestimation, Horak et al. (1989) found that older adults appeared able to control the COM motion beyond their perceived BOS stability limits when necessary.

Individual response to an external perturbation (i.e. a balance disturbance that is created external to the individual (Brown, Shumway-Cook, & Woollacott, 1999)) is another aspect of balance thought to be important for reducing fall risk. Typically when an individual undergoes a perturbation they react either by using a change in support or a fixed support reaction which keeps the COM within the BOS (Maki & McIlroy, 2006). A change in support reaction requires the individual to either take a step or reach for an object with their hand which changes the BOS thereby making it easier for the individual to maintain the COM within the BOS (Maki & McIlroy, 1997). This change in support reaction provides a larger degree of stabilization compared to the fixed support reaction (Maki & McIlroy, 2006). With a fixed support reaction, the motion of the COM is controlled by muscle torque while maintaining the BOS (Maki & McIlroy, 2006). Studies that have used forward and backward pulls to elicit a stepping response found that many older adults are more likely to take multiple steps to recover from a perturbation (Luchies, Alexander, Schultz et al., 1994; Wolfson, Whipple, Amerman et al., 1986). Additionally, older adults with a history of falling had more issues initiating and controlling the stepping response and were not able to prevent loss of balance (Wolfson et al., 1986). While young adults are typically able to recover from a lateral perturbation using a single crossover step (Takacs, Carpenter, Garland et al., 2013), older adults typically use a small medial step with the unloaded leg followed by a large lateral step with the other leg (Maki, Edmondstone, McIlroy, 2000). Maki et al. (2000) also reported that older adults were more likely than young adults to have a collision with the swing foot and stance limb regardless of the stepping response. Given the disruption of balance that such contact would create this strategy would appear to increase fall risk in older adults.

In addition to the alterations in postural response outlined above, researchers have also identified changes in trunk motions when older adults are subjected to a perturbation. According to Allum et al. (2002), older adults have small passive trunk movements that are in the same direction as the perturbation compared to young adults who have large trunk movements in the opposite direction of the perturbation. Allum et al. (2002) suggested that this biomechanical change might be due to increased trunk stiffness among older adults; a small trunk movement may not be sufficient enough to compensate for the perturbation. Direction of arm movement after a perturbation has also been observed. Older adults tend to have arm movement in the same direction as the perturbation whereas younger adults have arm movement in the opposite direction (Allum et al., 2002). It is thought that the change in arm movement is because older adults are reaching for objects in the direction of the perturbation to catch themselves before they fall (Takacs et al., 2013). The change in arm movement increases the COM displacement, which may actually serve to increase the probability of falling if the object being reached for is not grasped (Takacs et al., 2013). McIlroy and Maki (1996) also discovered that young adults were just as likely as older adults to initiate arm movement to grasp for a safety rail in the event of a fall. However, the speed of the execution of the arm movement was at a slower pace for the older adults (Maki, Edmondstone, Perry et al., 2001). If older adults do not execute the arm movement in sufficient time then a fall may be more likely.

In addition to the changes observed in these balance reactions, anticipatory postural adjustments (APA) typically become delayed with age (Man'Kovskii, Mints, & Lysenyuk, 1980). APAs help to ensure that postural stability is maintained during self-generated perturbations. One example of an APA would be the fact that voluntary arm movement is

preceded by a sequence of postural adjustments, which are reflected in the recruitment of the postural chain muscles (Bleuse, Cassim, Blatt et al., 2006). Proper execution of an APA helps maintain the COM within stability limits to ensure balance is sustained while moving from one body configuration to another (Leonard, Brown, & Stapley, 2009). Research suggests that mechanisms for producing an APA may be altered with age (Bleuse et al., 2006; Maki & McIlroy, 1996; Woollacott & Manchester, 1993). Bleuse et al. (2006) found that in order to grasp a handle in front of them older adults modify muscle activation sequences and exhibit increased activation of the quadriceps compared to younger adults when performing shoulder flexion. As a result of this change in strategy, the older adults were less stable. Similarly during self-paced rapid arm movement, older adults had different muscle activation sequences then younger adults (Bleuse et al., 2006). In a study completed by Woollacott & Manchester (1993), it was determined that older adults frequently recruited postural muscles later relative to younger adults during arm movement. Such delayed muscle recruitment can lead to instability if the body is not in the correct position to offset a perturbation. Maki (1993) conducted a study that found the magnitude of the anticipatory change in the ground reaction forces (GRFs) was larger in subjects who were at high risk of falling. Given the importance of APA in the maintenance of balance and stability, the APA changes that occur due to aging may be another mechanism that contributes to increased fall risk in older adults.

Muscle weakness is another intrinsic factor that is considered to be a fall risk factor. It is well known that muscle strength decreases with age (Grimby, 1995; Macaluso & De Vito, 2004). With age there is also a reduction in the size of the muscle known as sarcopenia (Evans, 1995), which in turn affects muscle force generation (Macaluso & De

Vito, 2004). It is essential for lower limb muscles to generate enough force to maintain balance to avoid a fall (Wolfson, Judge, Whipple et al., 1995). When comparing fallers and non-fallers, it has been well documented that fallers have greater lower extremity weakness (Lord, Ward, Williams et al., 1994; Moreland, Richardson, Goldsmith et al., 2004; Robbins, Rubenstein, Josephson et al., 1989). Hip movements are essential for balance recovery. In older adults, lateral stability, which is controlled by hip adductors and abductors, is the key contributor to maintaining postural control (Orr, 2010). If there is weakness in the hip muscles, then balance would be difficult to maintain when faced with an external perturbation (Horlings, van Engelen, Allum et al., 2008). Further evidence for the impact of strength and balance and falls risk can be found by examining intervention based research. For example short-term programs (8 to 10-weeks) that target lower limb training have resulted in significant improvements in strength of the lower body and balance in older adults (Schlicht, Camaione, & Owens, 2001; Yates & Dunnagan, 2001).

While the factors reviewed above are perhaps the primary intrinsic factors thought to increase fall risk in older adults they are by no means the only factors. Other intrinsic factors that contribute to increased fall risk includes vision and hearing deficits (Jacobson, McCaslin, Grantham et al., 2008, Yip, Khawaja, Broadway et al., 2014), loss of joint range of motion (Rose, 2011), vitamin D deficiency (Rothenbacher, Klenk, Denkinger et al., 2014), and slow reaction time (Barnett, Smith, Lord et al., 2003). As these factors are not directly addressed or related to the fall prevention intervention that will be employed in the current study, a detailed examination of this literature is beyond the scope of this review.

FEAR OF FALLING AS A FALL RISK FACTOR

All of the intrinsic factors outlined above are physical in nature. Fall risk, however, is not only influenced by physical causes, there are psychological / emotional aspects that

also contribute to fall risk (e.g., anxiety, depression, psychological distress, and feelings of well-being (Martin, Hart, Spector et al., 2005)). The most salient of these psychological factors is fear of falling.

Tinetti & Powell (1993) defined fear of falling as a lasting concern about falling that leads to an individual avoiding activities that he/she remains capable of performing. After a fall has occurred it has been shown that older adults can develop a fear of falling and also experience a decrease in their confidence levels related to their ability to complete daily activities without falling (Roe, Howell, Riniotis, et al., 2008). Close to 70% of older adults who experience a fall report developing a fear of falling again and 40% of older adults who have never fallen have a fear of falling (Tinetti, Mendes de Leon, Doucette et al., 1994). Roe et al. (2008) completed a qualitative study with semi-structured interviews to explore the experiences of older adults who had fallen. They reported that the amount of fear experienced was related to the severity of the fall and its consequences for the older adult. While some older adults in Roe's study did regain confidence as they recuperated, others accepted the fear of falling and loss of confidence as an inevitable part of falling.

It is important to appreciate the negative impact of this fear of falling. Fear of falling is not just associated with increased fall risk - it often results in activity restriction and avoidance (Delbaere, Crombez, Vanderstraeten et al., 2004). Quality of life may become compromised with excessive fear and avoidance even though injuries sustained from the fall may not be functionally limiting (Fletcher & Hirdes, 2004). Activity restriction can lead to other negative consequences including balance deterioration (Maki, Holliday, & Topper, 1991), functional decline (Tinetti et al., 1994), psychological/emotional changes such as depression (Vellas, Wayne, Romero et al., 1997),

decrease in social contacts (Arfken et al., 1994), and loss of leisure activities (Howland, Peterson, Levin et al., 1993). As was reported by Arfken et al. (1994), these negative consequences of fear of falling can, in turn lead to increased fall risk. Fear of falling then can become part of a viscous cycle – an older adult falls and becomes afraid of falling so they restrict their activity which in turn increases their risk of falling even more.

Clearly the increased fall risk observed in older adults is multifaceted in nature and complex to understand. Despite this complexity, there have been numerous successes when it comes to reducing fall risk in this population. A brief overview of this research will follow.

FALL PREVENTION RESEARCH

Much like the causal factors underlying fall risk, interventions aimed at reducing this risk focus on some combination of intrinsic and extrinsic risk factor reduction. The most successful interventions are those that take a multidisciplinary and multifactorial approach. Central to many of these interventions are some form of exercise intervention aimed at improving balance and strength. Key internal fall risk factors in older adults such as decreased muscle strength, reduced movement speed, and poor balance can be modified with exercise and there is now good evidence that exercise can reduce the incidence of falls themselves (Lord, Castell, Corcoran et al., 2003). Exercise interventions alone are not effective in older adults that are at very high risk of falling nor do they work well in individuals whose fall risk is very low (Lord et al., 2003). It is important to target individuals that will most likely benefit from the intervention. Research has shown fall prevention interventions are generally most effective among individuals over the age of 70

and who have at least one fall risk factor, females over the age of 80, and for individuals with balance or strength deficits (Barnett et al., 2003).

Many of the successful exercise interventions have had similar protocols. The exercise interventions generally include a warm-up period consisting of light stretching followed by exercises that improve balance, muscle strength, endurance, and flexibility (e.g., Barnett et al., 2003; Blank, Freiberfer, Siegrist et al., 2011; Brouwer et al., 2003; Pérula et al., 2012). The exercises classes are usually concluded with a cool down period of light stretching and deep breathing exercises for relaxation. The duration of the exercise intervention varies between studies ranging from 3 weeks to 1 year. Pérula et al. (2012) completed a three-week exercise intervention. During the three-week intervention a total of five classes, each lasting ninety-minutes, were held. The control group was given a consultation on fall prevention and an information leaflet. An eight-week exercise intervention with one sixty-minute session each week was conducted by Brouwer et al (2003). The intervention group participated in the exercise sessions and the control group attended education sessions about falls and fall prevention. Barnett et al. (2003) used a much longer intervention period in their study. These authors conducted their fall preventions classes over a period of one year with a total of thirty-seven classes. The control group received an educational session but no exercises were given. These studies were multidisciplinary in nature and provided various other components besides the exercise intervention. An education session was provided by Brouwer et al. (2003) discussing topics such as fall risk, nutrition, and footwear. Pérula et al. (2012) provided an information leaflet to their participants as well as home visits focused on risk factors in the home and ways to eliminate the risk.

Despite the variation in the duration of the fall prevention programs mentioned above, all studies reported an improvement in participants. Pérula et al., 2012 found that the intervention group had fewer falls then the control group after a one-year follow up and the control group had a greater fear of falling then the intervention group. Both the exercise and control groups showed improved balance confidence and a reduction in fear of falling in the study completed by Brouwer et al., 2003. The major difference between the two groups was the exercise group showed greater improvement in weight shifts (Brouwer et al., 2003). In the study completed by Barnett et al. (2003) they found the intervention group had a fall rate that was 40% lower than the control group.

The success of fall prevention programs can be attributed to numerous different reasons. Barnett et al. (2003) believed the success of their prevention program was due to the fact that it addressed the reduced physical function of the participants by emphasizing balance exercises. Since the program was multifaceted (i.e., balance, strength, endurance, and flexibility), it is difficult to determine the effect of each individual component. However, there was no improvement in participant strength and follow up determined the participants increased their activity level outside of the class. Barnett et al. (2003) attributed this to the focus on balance which gave the participants confidence in their abilities outside the class. Pérula et al. (2012) attributed the success of their prevention program to the home intervention that focused on eliminating fall risks in the home. Brouwer et al. (2003) discovered that fear of falling can be diminished with both an exercise or education intervention. However, Brouwer et al. (2003) found that improvement in balance was only seen in the exercise intervention group.

As seen from the interventions mentioned above, fall prevention programs can lead to a reduction in the rate of falls in older adults. However, older adults that are not participants in interventions continue to fall more often, and with more deleterious effects than in younger individuals. In order for fall prevention programs to be effective they must engage as many older adults as possible and be designed in such a way that they encourage adherence. Comparatively little research has been done on how best to ensure these two needs are met.

Many intervention programs have been designed based solely on the knowledge of fall risk factors with relatively little regard for the individuals who will be the consumer of such programs, which will likely result in deterring older adults from participating. In order for intervention programs to be as effective as possible they must have maximal participation of older adults in the community who, in turn, must remain committed to the programs for their duration. Research on program adherence has shown that in order to engage older adults in fall prevention programs benefits must be communicated effectively prior to program commencement (Yardley et al., 2006) and the program must be accessible (Dickinson, Machen, Horton et al., 2011). Research has shown that older adults will adhere to exercise programs if confidence levels increase, an improvement in quality of life is seen, or there is a sense of social support through established relationships as discussed below (Dickinson et al. 2011).

FACTORS THAT CONTRIBUTE TO PHYSICAL ACTIVITY PARTICIPATION IN OLDER ADULTS

As stated previously there is comparatively little research that has examined factors that influence older adults' willingness to engage in and adhere to fall prevention

programming. On the other hand there is a large volume of research examining these issues in relation to general physical activity. Exercise adherence literature will therefore be reviewed in order to highlight some of the factors that must be considered when designing fall prevention programming for older adults.

The importance of physical activity for the management of chronic disease, mortality, and morbidity has been well documented (e.g., McAuley, Jerome, Marquez et al., 2003; Pate, Pratt, Blair et al., 1995; Schuzter & Graves, 2004). However, research consistently shows that levels of physical activity decline with age (Schutzer & Graves, 2004). Therefore, it is important to understand the factors that influence participation and program adherence for older adults in order to properly promote programs to older adults. This section will examine some of these factors namely exercise self-efficacy, quality of life, and social support, each of which has been shown to contribute to older adults' adherence to exercise programs. Understanding what older adults enjoy in a program is essential in order to effectively design and promote a program for older adults.

IMPORTANCE OF EXERCISE SELF-EFFICACY FOR PHYSICAL ACTIVITY PARTICIPATION IN OLDER ADULTS

Exercise self-efficacy is a key factor that researchers have identified as being important for exercise initiation and adherence in young and old alike. Self-efficacy refers to the amount of self-confidence a person has in his/her ability to perform a specific activity (Bandura, 1997). As exercise-efficacy decreases so does the likelihood that an individual will participate in physical activity. It has been demonstrated that physical activity will influence and be influenced by exercise-efficacy (Bandura, 1997, McAuley & Blissmer, 2000). Brassington, Atienza, Perczek et al. (2002) conducted a study on exercise-efficacy in connection with exercise adherence in the elderly. The objective of the study was to

compare the relative abilities of cognitive mediating variables (i.e., exercise self-efficacy beliefs and exercise outcome expectancies/realizations) versus a social mediating variable (i.e., exercise-related social support) on exercise adherence during months 7 to 12 of an exercise intervention. Brassington et al. (2002) found that exercise-efficacy increased as perceived fitness-outcomes were realized. This finding indicates the importance of helping the elderly achieve fitness-related outcomes in order to improve levels of exercise-efficacy**.** The authors also discovered that increased self-efficacy was related to exercise adherence. It was found that change in self-efficacy was significantly related to 7-12 month exercise adherence.

Elavsky, McAuley, Motl et al. (2005) completed a study that examined the mediating effects of psychological variables (exercise self-efficacy, physical self-esteem, and positive affect) on the relationship between physical activity and satisfaction with life in older adults over a 4-year period. At the 1-year assessment it was discovered that physical activity had significant direct effects on all the psychological variables including exercise-efficacy. Participants who were more physically active had higher levels of exercise-efficacy and physical self-esteem. Additionally, exercise self-efficacy was associated with enhanced quality of life. A study completed by McAuley, Jerome, Elvasky et al. (2003) looked at predicting the long-term maintenance of physical activity in older adults using variables such as exercise self-efficacy, social support, and value judgments. It was determined that efficacy was related to physical activity adherence at 6 and 18-month follow-up. Based on the work of Elavsky et al. (2005), McAuley et al. (2003) and numerous other authors (Hiltunen, Winder, Rait, et al., 2005, Moore, Charvat, Gordon, et al., 2006, Resnick, Luisi, Vogel, 2006) it is evident that engaging in physical activity does

increase exercise self-efficacy in older adults and in turn creates exercise adherence. As such, gaining self-efficacy can positively impact the lives of older adults by giving them confidence to complete activities of daily living. Having confidence in themselves and their abilities may allow older adults to live independently.

Individuals with low self-efficacy tend to be less likely to engage in new activities and programs (Haines et al., 2014). However, those with low exercise-efficacy are often the ones that need physical activity the most. The same concept can be applied to older adults and the need for them to engage in fall prevention programs. Older adults that are unwilling to participate due to being afraid, nervous, or uninterested may very well be the ones that would see the most benefits of increasing their exercise self-efficacy. There is limited research about the role self-efficacy plays in determining whether individuals enroll in fall prevention programs, however, a study by Haines et al. (2014) has addressed this issue. Haines et al. (2014) focused on identifying the acceptability of fall prevention strategies as well as barriers and facilitators for older adults in attending fall prevention programs. Poor exercise-efficacy emerged as a theme in this study. Participants believed they could not participate in fall prevention programs due to physical limitations. Participants were not convinced of the benefits they would receive from engaging in an exercise program or other fall prevention strategies but thought others would benefit from such programs just not them personally. While this study did add some insight into how self-efficacy may influence fall prevention program adherence and success, clearly more research examining this issue would be beneficial.

IMPORTANCE OF PHYSICAL ACTIVITY FOR QUALITY OF LIFE

Quality of life can be defined as a conscious cognitive judgment of satisfaction with one's life (Pavot & Diener, 1993). As the proportion of older adult population increases,

maintaining a high quality of life into advanced age has become a growing public concern (Acree, Longfors, Fjeldstad et al., 2006). A high quality of life indicates individuals feel better, function better on a daily basis, and for most, live independently (Spirduso & Cronin, 2001). Physical activity interventions are an effective method of enhancing quality of life (Miller, Rejeski, Reboussin et al., 2000) in older adults by reducing functional decline and lessening the risk of disability (Keysor, 2003).

In a study completed by Elavsky et al. (2005) on the mediating effects of psychological variables on the relationship between physical activity and quality of life in older adults, it was determined that increased physical activity was associated with improved self-esteem and positive affect. Affect improvement was, in turn, found to have a direct effect on satisfaction with life. Acree et al. (2006) had similar findings in a study completed to determine if physical activity was associated with health-related quality of life (HRQL). It was discovered that healthy older adults who participated in regular physical activity of moderate intensity for more than one hour per week had higher values of HRQL than those who were less physically active. McAuley, Konopack, Motl et al. (2006) also completed a study on physical activity and quality of life, hypothesizing that physical activity is indirectly related to quality of life through the influence of self-efficacy and physical and mental health status. The results indicated that older women who were more active had greater self-efficacy, which was related to a more positive health status. Health status had a positive relationship with a higher quality of life. While the above studies clearly show a positive relationship between physical activity and quality of life, the author is unaware of any research that has examined whether such positive relationships exist between fall prevention program participation and quality of life. While based on the

existing literature such a relationship would be hypothesized to exist, research examining this question would be of value in the design and implementation of fall prevention programs.

IMPORTANCE OF SOCIAL SUPPORT ON PROGRAM ADHERENCE

Social support is of primary importance when beginning (or continuing with) an exercise program. The influence of this support however is often dependent on where the support is coming from. Bandura (1997) hypothesized that friends may strengthen self-efficacy expectations related to behaviours by providing encouragement and serving as role models. Work by Resnick, Orwig, Magaziner et al. (2002) examined the relative importance of family vs. friends in relation to activity adherence in older adults. This research concluded that friends have a stronger influence on exercise adherence in older adults than family or experts. The study also found that friend support indirectly influenced exercise through exercise-efficacy and outcome expectations. This finding supports future exercise interventions including social supports to strengthen self-efficacy related to exercise. This research by Resnick et al. (2002) suggests that support from family and friends are important in regards to an individuals exercise efficacy. Other research has found a positive association between physical activity participation among older adults and social support from instructors (Oka, King & Young, 1995) and group members (Dubbert, Cooper, Kirchner et al., 2002, Stevens, Lemmink, van Heuvelen et al., 2003). On the other hand long-term adherence to an activity program is more strongly influenced by activity leaders and group members (van Stralen, De Vries, Mudde et al., 2009) then family and friends. Interestingly, a negative association has been found between exercise participation and social support from health care providers (Burton, Shapiro & German, 1999). .

Based on the research mentioned above, social support has an effect on the overall experience of programs for older adults. McAuley et al. (2003) investigated the extent to which social, affective, and behavioral influences contributed to exercise-efficacy at the end of a 6-month exercise program. It was determined that there were significant direct effects of physical activity, affect experienced during activity, and exercise social support on exercise-efficacy. The participants that enjoyed greater social support within the exercise program, positive experiences, and a greater sense of efficacy at the end of the program were the ones that were frequently more active. Also, the participants that believed the exercise group provided greater support had stronger exercise-efficacy and reported exercise made them feel better.

Not only does social support affect older adults in fall prevention programs, social support is important for the success of other programs. Schoster, Callahan, Meier et al. (2005) completed a qualitative study on participants' satisfaction with the People with Arthritis Can Exercise (PACE) program. The participants mentioned that knowing the class was expecting them to show up each week was a significant motivation to attend class. Not only did fellow class members motivate participants' exercise adherence so did the social support from the instructors. The instructor's personality characteristics were important factors in the participants' perceived sense of support. Participants used words such as nice, patient, friendly, and polite to describe the instructor's personality traits that were important. It seems the participants' high regard for their instructor increased their desire to attend class and helped them feel safe engaging in the class exercises. The instructor's behavior was also important for the participants to feel supported during class. Behaviors such as paying personal attention to class members, looking up answers to participants'

questions, and understanding and suggesting appropriate exercises for arthritis were important to the participants. Van Stralen et al. (2009) conducted a review on determinants of initiation and maintenance of physical activity among older adults. Within this review it was realized that instructor support was essential for participant exercise adherence. It is important to participants to have a sense of support from their instructors in order to identify with the program.

Based on the studies discussed above, it is clear social support has an impact on exercise adherence. Encouraging older adults to participate in physical activity can be difficult, since they often believe they are too old or too frail for physical activity (Schutzer & Graves, 2004). Promoting the social experience may therefore be an effective method to encourage participation. As no research to the author's knowledge has been done examining the role that social support may play in fall prevention program participation, studies examining exercise programming on older adults may be applied since many fall prevention programs have an exercise component. Research in the area of social supports on fall prevention programming is needed.

PROGRAM PROMOTION

To ensure older adults reap the benefits of a fall prevention program, the program must be effectively promoted. Program design and promotion are important aspects of a fall prevention program to ensure attendance, participation, and adherence. Convincing older adults to join in physical activity programs can be a difficult task. For example in one study done by Robertson, Devlin, Gardner et al., 2001 uptake rates for community-based fall prevention programs average around 50%. Although the importance of physical activity is well known, older adults grew up in a time when exercise was not valued or deemed necessary (Schutzer & Graves, 2004). It is also a possibility that older adults do not identify

with the terms “old” or ‘seniors’ and may wish to distance themselves from others or activities that are associated with those types of terms. Therefore, physical activity information that is targeted at older adults may deter some people from participating especially if the information is seen as common sense or patronizing (Yardley & Todd, 2005). One method of overcoming this barrier to participation is to provide activities that allow older adults to defy stereotypes and provide a sense of pride and accomplishment (Bunn, Dickinson, Barnett-Page et al., 2008). Despite older adults not wanting to be deemed “old,” generally people like to be involved in programs that involve contact with people of similar age and outlook (Sharon, Hennessy, Brandon et al., 1997, Stead, Wimbush, Eadie et al., 1997). This barrier requires careful advertising that is not blatantly targeting older adults but will spark their interest in the program. In order for older adults to experience all the benefits of a fall prevention program, promotion is key. Effective promotion will spark the interest of older adults and the benefits mentioned above will ensure program adherence. To ensure older adults adhere to and enjoy fall prevention programming, it is important to understand their perceptions of fall risk and fall prevention.

OLDER ADULTS PERCEPTIONS OF FALL RISK AND FALL PREVENTION

In comparison to the abundance of research that has examined fall risk and fall prevention programming in older adults, relatively little work has been done examining how older adults view their personal fall risk and fall prevention programming. Such research is important because older adults who do not perceive their fall risk as significant or do not believe they need a fall prevention program will likely not attend any programming, regardless of its effectiveness. Haines et al. (2014) completed a cross-

sectional survey to determine why community-dwelling older adults feel fall prevention programs are better suited for others than themselves. This study found that few older adults were convinced of the benefits of exercise and fall prevention strategies for people like them. The work by Yardley et al. (2006) discovered that the participants believed the information on fall prevention was useful but felt it was not appropriate for them and that they felt they did not need the information. Participants that described themselves as fit thought that only frail and disabled older adults would benefit from the information. A common suggestion among the older adults in this study was that fall prevention information would be more useful to adults older than themselves or that it was common sense. Collectively Haines and Yardley's work demonstrated that older adults, at least for the older adults who participated in their studies, were well aware of the risks of falling. Unfortunately, most of the older adults in this research did not appreciate the fall prevention advice as they felt they were able to manage their own life and held the belief that fall prevention programming was not suited for them.

Older adults' perceptions that fall prevention programs are not personally beneficial have been documented. Dickinson et al. (2011) completed a qualitative study surrounding the views of older adults in an effort to identify barriers and facilitators to participation in fall prevention interventions. An important facilitator discovered by Dickinson et al. (2011) was hearing about an intervention from others such as friends and relatives. This was an effective stimulus for attendance. Another facilitator was the appropriate level and type of activity with the majority of participants expressing the preference of being in a group aimed towards older adults to ensure the level of activity would be suitable for them. Dickinson et al. (2011) also discovered that experiencing benefits while attending an

intervention helped with program adherence. Participants that saw physical improvements in strength and balance, and experienced social and emotional benefits were appreciative of the intervention.

In addition to facilitators for program participation, Dickinson et al. (2011) also noted barriers to intervention adherence. These including lack of knowledge about the intervention, perception of benefits of the program and the time commitment required to participants. With the main barrier, lack of knowledge and information, it was realized that participants were reluctant to attend an intervention if they had no prior knowledge of what to expect or if little information was provided. Also Dickinson et al. (2011) found that if individuals did not believe there to be any benefits from participating in an intervention then adherence was unlikely. In addition the barrier of lack of time characterized how older adults, despite being retired, often have other commitments and found it difficult to attend an intervention regularly. There were also time pressures when the participant had responsibilities of caring for another individual such as spouse or grandchild (Dickinson et al., 2011).

Simpson, Darwin & Marsh (2003) also completed a qualitative study with semi-structured interviews with older adults that examined which strategies older adults were willing to take to prevent falls. The authors found that participants were not aware of the benefits of exercise on fall prevention and many had reservations about participating. The participants explained their hesitation about exercising was due to their fear of increased pain, it requiring significant effort, and the belief they were too old (Simpson et al., 2003).

The research by Haines et al. (2014), Yardley et al. (2006), Dickinson et al. (2011) and Simpson et al. (2011) is extremely valuable for the initial insight it provides in to how

older adults perceive both fall prevention programs and their own fall risk. What is unclear at this point is how universal these findings are. In other words, do they apply to older adults living in geographical locations other than the ones studied? Of particular interest for the present research is whether or not older adults living in NL share the same views. As a province currently just beginning to develop a fall prevention strategy, this information would be invaluable to researchers and consultants working on program design.

CONCLUSION

Falls in older adults are a serious issue that can dramatically reduce quality of life. In an effort to reduce falls in this population much research has been done examining both the underlying cause of increased fall risk and the best ways to reduce this risk and prevent falls. Based on the above review of literature it is clear that fall prevention requires a multifactorial approach that addresses both the intrinsic and extrinsic fall risk factors. Such programs must address physical capabilities such as balance, strength and flexibility, as well as education on environmental risk factors. To date researchers have done a very thorough job of quantifying these physical capabilities and assessing program effectiveness. Less research attention has been paid to the psychological/emotional aspects of these programs. If programs are to effectively reduce fall rates, as many older adults as possible need to be involved. Drawing on general physical activity literature it is clear that psychological/emotional factors such as self-efficacy and social support and issues such as the quality of life impacts are likely to be important when trying design programs that will be of interest to older adults. Similarly improved understanding of how to best promote such programs to older adults is needed. Based on the above review of literature the following research questions and hypothesis were used for this study:

RESEARCH QUESTIONS:

1. How do older adults living in rural Newfoundland and Labrador community perceive their fall risk and fall prevention programming?
2. How do participations of a 10-week fall prevention program run in a rural Newfoundland and Labrador community perceive this program?

CHAPTER THREE
METHODS

The primary goal of this research was to gain insight in to how a sample of NL older adults perceived their fall risk and fall prevention programs in general. While this goal could likely have been satisfactorily reached by only talking to older adults about their perceptions and beliefs such an approach would not have enabled the researchers to gather any information about how older adults experience participation in a fall prevention program. For this study, a mixed methods approached was used. The study consisted of a fall prevention program as well as speaking with the participants in order to receive both an objective and subjective view. Given the physical activity literature that has outlined the importance of efficacy and social support to physical activity participation it was felt that such insight would be extremely important to gather. As such this research consisted of two parts:

1) A 10-week fall prevention program was carried out with an intervention group. A variety of fall risk measures were assessed in both program participants and an age matched control group (quantitative). The control group participated in the pre-test and post-test measures and was excluded from the 10-week fall prevention program.
2) Two focus groups were conducted: one with fall prevention program participants and one with the control group. These focus groups enabled researchers to probe deeply into both older adults perceptions of their own fall risk and also their experience in the fall prevention program (qualitative).

These two aspects of the research are described in detail below.

QUANTITATIVE METHODS

FALL PREVENTION PROGRAM PROCEDURE

Prior to beginning the prevention program all participants completed a consent form and the Physical Activity Readiness Questionnaire (PAR-Q). A pretest-posttest experimental design was used for this study. Prior to the start and at the end of the 10-week exercise program (or prior and at the end of the control group's 10-week control period) all participants were assessed using the following measures:

1) Postural sway was measured while participants stood in one of three different quiet standing conditions – two legs eyes open, two legs eyes closed, and one leg eyes open. Each stance was held for 30 seconds and tested three times in a randomized order. All standing trials were completed on a portable force measuring device that was constructed using two Wii® balance boards (WBB). In a study completed by Ma (2012) it was shown that the WBB is a valid tool for measuring balance. Ma (2012) determined the WBB had minimal drift, high linearity, low hysteresis, mass accuracy, uniformity of response, and center of pressure (CoP) accuracy. The WBBs were used in place of a force plate. The boards were lined up along the longitudinal axis as per Ma (2012; See Fig. 1). The standing position was standardized as directed by McIlroy & Maki (1997) and marked with black tape. Heels were set 17 cm apart at an angle of 16.6^{o} from heel to the middle toe. If the participants were unable to complete the first trial of one-legged standing then the other two trials were omitted.

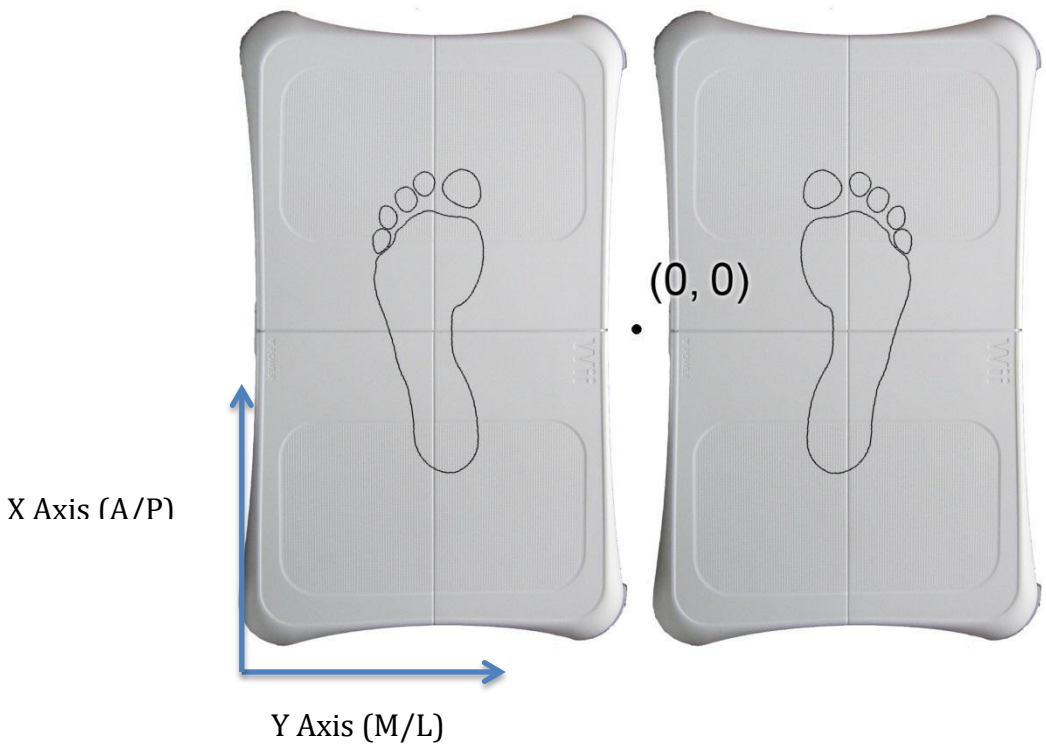

Figure 1: Orientation of Wii® Balance Board (Ma, 2012, p.31)

2) Foam and Dome Test (based on work by Khatter & Hathiram (2012)): This test used two conflicting somatosensory inputs and three conflicting visual inputs to test an individual's balance. The two somatosensory inputs used were standing on a hard floor or standing on a foam surface. For both surfaces individuals were asked to maintain balance under each of three visual conditions – eyes open, eyes closed and eyes open with a dome placed over the head. The dome acted to remove all reference to the surroundings and as such produced visual input that did not provide any reference to vertical, thereby requiring individuals to rely more heavily on vestibular input (Shumway-Cook & Horak, 1986). In total, there were six balance conditions tested: eyes open on the floor, eyes open on the foam, eyes closed on the floor, eyes closed on the foam, dome on the floor, and dome on the foam. The order

of the six conditions was randomized for each participant. For all conditions participants were instructed to stand on the designated surface with their ankles touching and hands placed by their side for up to 30 seconds. If the participants were unable to hold their stance during the first trial they were allowed to have up to three trials to complete the condition. The dome used in the study was constructed based on instructions provided in Shumway-Cook & Horak (1986).

3) Timed Up and Go (TUG) Test (Shumway-Cook et al. (2000)): The TUG test is a simple fall risk-screening tool for individuals living on the community. It measures functional mobility since it incorporates transfer tasks, walking, and turning. A poor performance on the TUG test is associated with muscle weakness, poor balance, fear of falling, and impairments relating to basic activities of daily living (Schoene, Wu, Mikolaizak et al., 2013). In the current study each participant completed three trials of the TUG test. A wooden chair with armrests was used for this test. A black X was taped on the floor 3m away from the wooden chair. Participants started the test sitting in a chair. When instructed to do so they were required stand, walk to a black X at a normal walking pace, turn around at the X, walk back towards the chair, and then sit down. Each trial was timed using a stopwatch. Also whether participants used the armrests to assist them while standing and sitting was noted. All participants were given a practice trial before the test began.
4) Participants completed 4 questionnaire scales designed to assess a variety of aspects of fall risk and falls and exercise self-efficacy. The questionnaires used were:
    a. The Falls Efficacy Scale (FES) measured the participant's fear of falling (Tinetti, Richman & Powell, 1990).

b. To assess the participant's confidence in their ability to complete the 10-week exercise program the Exercise Self-Efficacy (ESE) Scale was used (McAuley, 1993).
c. The participants completed the Activities-Specific Balance Confidence (ABC) Scale to determine their perception of their confidence in situations where their balance may be challenged (Powell & Myers, 1995).
d. Each participant completed the Survey of Activities and Fear of Falling in the Elderly (SAFFE). The SAFFE determines whether individuals avoid certain activities due to fear of falling (Lachman, Howland, Tennstedt et al., 1998).

During the pre-test and post-test sessions, the questionnaire scales were completed first followed by the three balance assessments in a randomized order. The control group underwent the same pre-test and post-test measures as the intervention group. The TUG test, postural sway, foam and dome test, falls efficacy scale, ABC Scale, exercise self-efficacy scale, and SAFFE have been used by countless authors in research that has focused on this issue (e.g., Anacker & Di Fabio, 1992, Clemson, Cumming, Kendig et al., 2004, Delbaere et al., 2004, Girardi, Konrad, Amin et al., 2001, Lamb, Jorstad-Stein, Hauer et al., 2005, Li, Fisher, Harmer et al., 2005, Powell & Myers, 1995, Shumway-Cook et al., 2000, Thrane, Joakimsen & Thornquist, 2007, Tinetti et al., 1990). All tests have been shown to both valid and reliable methods (Cabrera, Anzano, Herrera Sanchez et al., 2011, Clark, Bryant, Pua et al., 2010, Cohen, Blatchly & Gombash, 1993, Lachman et al., 1998, Powell & Myers, 1995, Shumway-Cook et al., 2000) of quantifying fall risks, balance ability, balance confidence, falls efficacy, and exercise efficacy

The intervention group completed a 10-week exercise program consisting of two, 60-minute sessions a week. These sessions took place at a community center in the town of Holyrood, Newfoundland and Labrador. The researcher and a senior level kinesiology co-op student from Memorial University of Newfoundland and Labrador delivered the exercise program. The program was based on the Fallproof program (Rose, 2009). The exercises were designed to challenge participant's balance, strength, endurance, and flexibility. Every exercise class followed the same structure. It started with a 10-minute warm-up, 45 minutes of exercises, and 5 minutes of stretching. The warm-up was dynamic in nature. It consisted of walking with direction and pace changes as well as high knees and arm movements. There were a variety of exercises given throughout the program and the difficulty increased as the participants developed their skills. All of the exercises challenged the participants' balance by implementing perturbations, introducing stepping strategies, reducing the base of support and having participants do activities on a compliant surfaces such as a foam balance pad (Airex Balance Pads, see Fig. 2). Initially the participants stood on the pads to adjust to the feeling. Once they were comfortable the participants' balance was challenged by asking them to stand in semi-tandem and then tandem stance while standing on the foam balance pad. Balance was further challenged by asking them to close their eyes in different stances. Finally, arm movements were introduced. Other exercises included catching and throwing a balloon or weighted ball, kicking a ball, playing racquet sports, and relay races. A variety of exercises were included to assist with muscle strength such as using weighted objects, sit-to-stand to improve leg-strength, and using resistance bands for upper and lower extremities. Each exercise session ended with participants completing an obstacle course. This course was comprised of

reaching exercises, sit-to-stand exercises, and balance exercises such as standing on one leg and on foam balance pads, stepping over obstacles, tandem walking, jumping, and carrying weighted balls. The difficulty of the obstacles progressed as the participants' abilities improved. The participants would provide instructors with feedback on the difficulty and enjoyment of the exercises. The class concluded with full body stretching.

Figure 2: Airex Balance Pad used during 10-week exercise program

An education session was provided between the pre-test and post-test period. Both groups attended the same session. A researcher not directly involved in the exercise classes delivered the session. The education session provided participants with information about extrinsic factors that are known to increase fall risks. They included both environmental and lifestyle risk factors. Suggestions were given to the participants on methods to reduce risk factors in and around their home as well as new techniques to complete activities of daily living that will decrease the likelihood of a fall occurring. The participants were also provided with general information about falls and some of the consequences of falls.

PARTICIPANTS

The participants recruited for this study were community dwelling older adults (age range 65-85) living in Newfoundland and Labrador. All participants were independently ambulatory, with no cognitive or physical impairments that prevented them from engaging in physical activity. To recruit participants for the study an advertisement was placed in a

community flyer that was distributed monthly to the rural community of Holyrood, population 1995 (Statistics Canada, 2012). An information session was held to give potential participants more insight into the study. For this portion of the study participants were placed in either the intervention or control group. Random assignment was not used as there were several participants interested in being involved who could not commit to the exercise portion of the program – as such, group assignment was done based on participant preference. The intervention group had 11 participants and the control group had 9 participants.

DATA ANALYSIS

WBB Postural Sway

The WBB data was analyzed by quantifying a variety of postural sway measures. Data output from the WBB testing consisted of two separate data files for CoP calculations, one file from each WBB. Based on the work of Ma (2012) the following equations were used to determine net CoP motion during each of the standing trials:

$$CoP_{ML} = (CoP_{ML} \text{ left } -15cm) * \%left + (CoP_{ML} \text{ right } + 15cm) * \%right \quad \text{Eqn. 1}$$

$$CoP_{AP} = (CoP_{AP} \text{ left } * \%left) + (CoP_{AP} \text{ right } * \%right) \quad \text{Eqn. 2}$$

where %left and %right refer to the percentage of mass distributed on the left and right WBB respectively, CoP_{ML} left/right and CoP_{AP} left/right refer to the CoP position for the left and right boards respectively. The +15cm and -15cm found in equation 1 account for the center-to-center offset of the two WBB (i.e. the distance between the centers was 30cm). Using the above equations, CoP coordinates were calculated for each stance using custom designed software written in Matlab (version R2013a).

In order to compare pre-test and post-test body sway for each participant, various CoP parameters were then calculated. The CoP parameters include mean sway velocity,

range in anterior-posterior (AP) and medial-lateral (ML) directions, CoP trajectory, area of the sway region, and standard deviation of displacement. Raymakers, Samson & Verhaar (2005) provide the equations for the parameters:

$$\text{Vd (displacement velocity)} = \frac{\sqrt{((CoPxi - CoPxi\text{-}1)^2 + (CoPyi - CoPyi\text{-}1)^2)}}{(ti - ti\text{-}1)} \quad \text{Eqn. 3}$$

where CoPi = initial CoP, CoPi-1 = previous CoP

$$\text{Vm (mean velocity)} = \frac{\Sigma Vd}{t} \quad \text{Eqn. 4}$$

where t is trial length

$$\text{Range AP} = |APmax - APmin| \quad \text{Eqn. 5}$$

$$\text{Range ML} = |MLmax - MLmin| \quad \text{Eqn. 6}$$

$$\text{Total length of path travelled by CoP} = \sqrt{((CoPx\ length)^2 + (CoPylength)^2)} \quad \text{Eqn. 7}$$

$$\text{Standard deviation of displacement} = \sqrt{(\sigma^2 x + \sigma^2 y)} \quad \text{Eqn. 8}$$

where σ2x and σ2y = squared estimated standard deviation of x and y

Foam and Dome Test

Participants were given up to 3 trials to try and maintain a balanced stance for 30 seconds for each 6 test conditions. If the participant was able to hold the stance for 30 seconds on the first trial then they bypassed the other two trials and were given a score of 90. If the participant was not able to hold the stance for the full 30 seconds on the first trial, their score (i.e. the time they held it for) was recorded and they were given another trial to try and reach 30 seconds. If the participant was not able to hold the stance for thirty seconds on the second trial then their time was recorded and they were given a third attempt. The

total time for each of three trials was added together to give a total for each balance condition. The maximum score a person could attain on this test was 90 (Cohen et al., 1993).

TUG Test

The TUG test was conducted three times and each trial was timed. The analysis was based on a study conducted by Shumway-Cook et al. (2000). The mean time was found from the three trials. When interpreting the results times below 10 seconds were considered normal while scores above 14 indicated that participants were at increased risk of falls. Addition scoring details can be found in Shumway-Cook et al. (2000).

Questionnaire Data

The scores from the FES were totaled for each participant. The maximum score a participant could attain was 100 and the lowest score was a 10. A score above 70 would indicate the participant had a fear of falling. The scoring for FES was based on Tinetti et al. (1990).

The ESE Scale scores for each participant were totaled and divided by the number of questions to give a percentage score that could range from 0 – 100% (McAuley, 1993). The score for ABC Scale was determined in exactly the same manner (Powell & Myers, 1995).

The SAFFE was scored based on three different categories – activity level, fear of falling, and activity restriction. The activity level was scored out of 11. A "yes" response was scored 1 and "no" was 0. Once coded a total was determined. Fear of falling scores were coded so low scores meant low fear. A response of "not at all" was 0, "a little worried" was 1, "somewhat worried" was 2, and "very worried" was 3. The fear scores were then averaged across as many activities that were answered, "yes" in the activity level.

For the activity restriction questions only the number with the response "less then used to" were counted. This score could range from 0-11. To determine activities that were not completed due to reasons other than fear of falling the "not at all worried" responses were counted. This score could range from 0-11. To determine the number of activities that were not completed because of other reasons in addition to fear of falling the number of "yes" responses were counted. This score could range from 0-11. The scoring for this questionnaire was based on Lachman et al. (1998).

Once the raw data was analyzed a 2-way mixed repeated measures analysis of variance (ANOVA) was completed using SPSS. The factors used were group (intervention and control) and time (pre-test and post-test). All data assessed during pre and post-test sessions were compared using this analysis approach. A p-value of $p<.05$ was used. Significant effects were further examined using post-hoc Bonferroni assessments.

QUALITATIVE METHODS

INTRODUCTION

According to Stewart (1990), focus groups are one of the most widely used research tools in the social sciences. This is a method of collecting qualitative data that provides a rich body of data expressed in the respondents' own words and contexts. Focus groups are used to obtain the opinions, values, and beliefs from an identifiable group using a facilitated interview technique (Halcomb, Gholizadeh, DiDiacomo et al., 2007). The main advantage of a focus group is the ability to observe a large amount of interaction on a topic in a short time period (Morgan, 1997, pg. 15). Another advantage is a group discussion can produce material that would not come out in an individual interview (Morgan, 1997, pg. 21). Data is generated through the opinions expressed by participants (Halcomb et al., 2007). There is a

minimum of artificial responses due to the fact that participants can qualify their responses, which provides ecological validity (Stewart, 1990, pg. 12). Focus groups are useful for exploratory research when little is known about the topic of interest (Stewart, 1990, pg. 15). There is also a use for focus groups when a researcher needs information to give depth to the data for a quantitative study (Krueger & Casey 2000). The assumption is that individuals are a valuable source of information and are capable of expressing their own feelings and behaviors (Clarke, 1999).

PARTICIPANTS

The selection and recruitment of participants for focus groups is an important task. Individuals invited to participate must be able to provide the desired information and must be representative of the population of interest (Stewart, 1990). Barbour (2007) supports selecting participants via purposive sampling where participants are selected from pre-existing groups with the sample selected to include people of interest about a specific purpose. Generally, the recommended size of a focus group is between 6 to 12 participants (Morgan, 1997, Robinson, 2012, Stewart, Shamdasani & Rook, 2009).

Focus group subjects for this study were recruited from the pool of participants involved in the fall prevention program portion of this research. Participants from the intervention group were verbally invited to attend at the end of a fall prevention class. Eleven participants were invited from the intervention focus group and 10 of these agreed to attend the focus group session. Participants from the control group were contacted by phone to determine their level of interest in attending the focus group. The control focus group had 6 participants even though 9 participants were invited to contribute.

The focus groups took place in the same community center as the 10-week fall prevention program in Holyrood, NL. The participants were given a brief explanation of the

research and were informed an incentive would be given in the form of a meal (Stewart, 1990). Information on time and place was also given to the participants during the initial point of contact with a follow-up reminder 24 hours prior to the focus group session (Stewart, 1990). The two groups attended separate sessions lasting approximately one hour. Prior to participating in the focus groups, all participants completed and signed an informed consent form.

DATA COLLECTION

Kitzinger (1995) defines focus groups as a form of group interview that capitalizes on communication between research participants in order to generate data. This qualitative technique was chosen for this study to gain insight into the thoughts and perceptions of older adults living in NL surrounding falls and fall risk factors. For the purpose of this study, both sessions were audio recorded. The focus groups were facilitated by two graduate students and took place at the end of the 10-week intervention period.

The sessions began with an open-ended question inviting participants to share their fall stories. The intent of telling these stories was to encourage sharing within the group and to put participants at ease as the validity of focus group data is affected by the extent to which participants feel comfortable about openly communicating their ideas and opinions (Cartwright, 1968). This initial question was followed by a series of open-ended questions and various associated probes (see Appendix A). Open-ended questions are non-directive questions that give the participants as much leeway as possible for their responses (Krueger & Casey, 2001). Probes were used when more detail was needed (Stalmeijer, Mcnaughton & Van Mook, 2014), to elicit additional perspectives, feelings and experiences (Ryan, Gandha, Culbertson et al., 2014; Trumbell, 2005), or to ensure all participants had equitable opportunity to contribute to the conversation (Ryan et al., 2014). The questions were

designed to enable participants to voice their opinions on the fall prevention program and how it could be improved. There were also questions aimed at understanding the participants' perception of their fall risk, perception of their exercise abilities and their motivation to attend the fall prevention program. The questions were organized in such a manner that general questions were asked in the beginning and specific questions came later in the session when the participants were more comfortable with sharing information (see Appendix A).

DATA ANALYSIS

Audio recordings of the focus group sessions were used to create verbatim written transcripts of each session. The names of participants were not indicated on the transcripts. According to Stewart et al. (2009) transcription not only allows for further analysis, it also establishes a permanent written record of the interview that can be shared with other interested parties. The transcription was completed in Microsoft Word and cut-and-pasted to a Microsoft Excel document for the next phase of data analysis—coding and sorting. Coding data is meant to fracture the data for interpretation and further analysis (Strauss, 1990). The coded data was then grouped and clustered to form various categories. The final step was to determine the overall themes based on the categories.

During the coding process, the first step was to identify sections that were relevant to the research question (Stewart, 1990). A classification system for major topics was developed and material related to each topic was identified (Stewart, 1990), which was done by searching through the data for regularities and patterns and recording words and phrases to represent the data. The words and phrases assigned to the data are known as codes. Codes are simply an attempt to categorize pieces of data with reference to key themes developed by the researcher (Barbour, 2010). This phase required a number of

passes through the transcript in order to ensure that optimal insight was gained about both the content and categories contained in the data (Stewart, 1990). Once the coding process was complete the data was sorted so all relevant material was grouped together.

There are three types of codes that were used for this type of data—descriptive, interpretive, or pattern (Miles & Huberman, 1994). In the beginning stages of coding the focus group data, descriptive and interpretive codes were used. A descriptive code is given to a piece of information in the transcript that describes what is being portrayed in that information (Miles & Huberman, 1994). For example, a participant described a moment in time when she fell in her kitchen while wearing socks. To represent this information "sock" was the descriptive code given. An interpretive code is generally applied as the researcher becomes more knowledgeable with the data (Miles & Huberman, 1994). For example, risk factor awareness was one interpretive code used. Table 1 provides some examples of the coding process.

Further into the coding process different types of risk factor awareness began to emerge such as environmental risk factor awareness and personal risk factor awareness and the codes become more specific to the data. Once the initial codes were complete, pattern coding was then used to group the codes (Miles & Huberman, 1994). Once a coding scheme was in place, the same method was applied to the control group transcript (Morgan, 1997) however additional codes were used when necessary. Codes were applied to the data using inductive reasoning. Inductive reasoning is an analysis tool supported by Strauss (1990) when transcripts are reviewed line by line and codes are applied. Stalmeijer et al. (2014) states that this method is common in exploratory studies that are early on in a research program.

Table 1: Focus group coding process

Quote	Descriptive Code	Interpretive Code
I find what this program has done for me too it has made me more conscious of falling it was never in my mind before but now when I go to the top of the stairs I make sure the light is on or if there's something on the floor I'll make sure I take my time.	Stairs, lighting	Environmental Risk Factor
I fell the other day. It was because I was rushing. I didn't realize that until we had done that seminar here and I know it was my own fault I was rushing out the door and I tripped and fell on my knees on the patio. It's now making me more aware.	Rushing	Personal Risk Factor
I'm very wary about going out when it's dark and slippery and I scuff on ice.	Ice	Environmental Risk Factor

Once the coding was complete the codes were clustered and partitioned into categories with the help of an independent researcher to reduce the data into manageable units (Miles & Huberman, 1994). The categories were determined by first sorting the codes in excel so they were in alphabetical order. Alphabetizing the codes created organization within the document. Identifying common ideas among the codes then generated categories. For example, codes such as lights, stairs, socks, and laundry were clustered together to form the category risk factors. The transcripts from each of the groups were coded and clustered into categories separately. Once all the codes are placed in a category, the categories were then counted to produce a numerical description of the data (Morgan, 1997). The reason behind this approach was to identify the large categories and to determine which categories were too small to standalone (Morgan, 1997).

Once the categories were established for both groups, the categories were combined to determine the overall themes. In order to successfully group the categories into themes, a categories list was placed on a white board and the researcher and an independent researcher placed similar categories together to form a theme. The categories that arose most often in the focus group data were set as a theme and smaller categories were combined to form a theme. For example, the theme of risk factor awareness was large enough category to become its own theme whereas the connectedness theme was created from a few smaller categories that were grouped together. Five themes were derived from the categories. To support the themes and to improve the data, quotes were selected to demonstrate the points being made by the participants (Morgan, 1997). Selecting quotes from the data to represent the theme can be difficult. The selection choice should be influenced by the purpose and intent of the study (Krueger & Casey, 2000).

QUALITY OF DATA

In order to ensure quality of data, findings must be deemed truthful and trustworthy. Trustworthiness of a research study is important for evaluating its worth (Lincoln & Guba, 1985). To establish trustworthiness of the research findings the following criteria was used: credibility, transferability, dependability, and confirmability (Lincoln & Guba, 1985, Miles & Huberman, 1994).

Credibility

Lincoln & Guba (1985) define credibility as confidence in the "truth" of the findings. As stated by Miles & Huberman (1994) do the findings of the study make sense? To ensure credibility in this study, the following questions were taken into account: was data linked to categories of prior literature, were areas of uncertainty identified, and was negative evidence considered (Miles & Huberman, 1994)?

Transferability

Transferability is defined as showing that findings have applicability in other contexts (Lincoln & Guba 1985). To verify that the findings of this study were capable of being transferred to other contexts, the following points were considered: characteristics of the participants, setting, and methods were fully described to compare to other samples, conclusions were general enough to be used in other settings, and the findings showed some consistency with previous studies (Miles & Huberman, 1994).

Dependability

Lincoln & Guba (1985) define dependability as showing that the findings are consistent and can be repeated. Miles & Huberman (1994) determined that dependability is whether the process of the study is consistent, reasonably stable over time and across researchers and methods. For this study the following points were considered: ensuring research questions were clear, data was collected across the full range of appropriate settings, times, and respondents, and peer review was in put in place.

Confirmability

Confirmability is defined by Lincoln & Guba (1985) as a degree of neutrality or the extent to which the findings of a study are shaped by the respondents and not researcher bias, motivation, or interest. To ensure confirmability in this study, the following points were considered: are the studies methods and procedures described in detail, was the sequence of data collection and analysis fully described, and are examples of the data provided for the reader (Miles & Huberman, 1994).

CHAPTER FOUR
QUANTITATIVE RESULTS

Twenty-one individuals participated in this study (11 intervention group, 10 control group). The average age of the participants was 71.6 years (*SD* = 5.42) with an age range of 64-83 years. There were 20 female participants and 1 male participant. One participant from the intervention group completed the pre-test measures and the 10-week exercise program but did not return for the post-test measures due to family issues. One participant from the control group completed all of the pre-test measures however upon completing the post-test questionnaires the participant decided not to complete the post-test balance assessments. As such the results presented below are from 10 intervention and 9 control participants.

PSYCHOSOCIAL VARIABLES

Homogeneity of variance was tested for all questionnaires and balance assessments using Levene's Test and Mauchley's test for sphericity. There was no significance found ($p > .01$) which indicates equal variance can be assumed between groups since the test was not violated.

The ABC Scale indicates self-perceived balance confidence with a score of 100 indicating an individual has complete balance confidence while doing activities of daily living (ADL). Results of the 2-way ANOVA indicated that there was no significant main group effect ($F_{(3,36)} = 0.21$, $p > .05$) and no interaction effect ($F_{(3,27)} = 0.34$, $p > .05$). The intervention group demonstrated an increase in balance confidence from pre-test ($M = 81.8$, $SD = 16.72$, $SE = 5.29$) to post-test ($M = 83.8$, $SD = 10.63$, $SE = 3.36$) as seen in Table 2. The control group had a slight decrease in ABC Scale scores from pre-test ($M = 86.4$, $SD = 12.13$, $SE = 3.83$) to post-test ($M = 84.8$, $SD = 13.15$, $SE = 4.16$) as seen in Table 3.

Table 2: Intervention Group: Mean, SD, SE, and Range of Scales

	ABC Scale		FES		ESE Scale	
	Pre-test	***Post-test***	***Pre-test***	***Post-test***	***Pre-test***	***Post-test***
Mean	81.8	83.8	17.3	10.9	84.4	92.4
SD	16.72	10.63	16.01	2.23	21.19	15.37
SE	5.29	3.36	5.06	0.71	6.70	4.86

Table 3: Control Group: Mean, SD, SE, and Range of questionnaires

	ABC Scale		FES		ESE Scale	
	Pre-test	***Post-test***	***Pre-test***	***Post-test***	***Pre-test***	***Post-test***
Mean	86.4	84.8	16.6	12.5	87.8	92.0
SD	12.13	13.15	14.71	4.09	15.91	12.59
SE	3.83	4.16	4.65	1.29	5.03	3.98

The 2-way ANOVA for the FES indicated there was no significant differences found between groups ($F_{(3,36)} = 0.78$, $p > .05$) and no interaction effect ($F_{(3,27)} = 0.81$, $p > .05$). The FES score for the intervention groups decreased from pre-test ($M = 17.3$, $SD = 16.01$, $SE = 5.06$) to post-test ($M = 10.9$, $SD = 2.23$, $SE = 0.71$) as seen in Table 1. The control group also saw a decrease in FES score from pre-test ($M = 16.6$, $SD = 14.71$, $SE = 4.65$) to post-test ($M = 12.5$, $SD = 4.09$, $SE = 1.29$) as seen in Table 2. A score above 70 would indicate a fear of falling. Both groups had scores well below 70, which indicates the participants had confidence they would not fall while conducting ADL. The FES scores indicate the intervention group had less fear of falling then the control group during the post-test, although these differences were not significant.

Both the intervention and control groups saw an increase in the ESE Scale scores as seen in Tables 2 and 3 even though the 2-way ANOVA indicated there was no significant difference found between groups ($F_{(3,36)} = 0.53$, $p > .05$) and no interaction effect ($F_{(2.69,24.21)} = 0.71$, $p > .05$). The intervention group demonstrated a slightly larger increase from pre-test ($M = 84.4$, $SD = 21.2$, $SE = 6.70$) to post-test ($M = 92.4$, $SD = 15.37$, $SE = 4.86$) then the control group ($M = 87.8$, $SD = 15.9$, $SE = 5.03$; $M = 92.0$, $SD = 12.59$, $SE =$

3.98, respectively). The ESE Scale scores indicate the intervention group had more confidence than the control group in their ability to complete moderate intensity exercise over an 8-week time period. A score of 100% on the ESE scale indicates complete confidence in completing exercise at moderate intensity 3 times a week for 8 weeks. All participants indicated moderate confidence in their exercise self-efficacy (>50) in both the pre-test and post-test. However, several participants in both groups showed a decrease in their ESE scale scores, which indicates there was a decline in their exercise self-efficacy from pre-test to post-test.

The SAFFE questionnaire has 5 questions that were scored individually. Question A represents the activity level, B is fear of falling, C demonstrates the number of activities restricted due to reasons other than fear of falling, D represents the number of activities restricted due to reasons in addition to fear of falling, and E is activity restriction. A 2-way ANOVA was conducted on the questionnaire data and all of the questions were deemed insignificant ($p > .05$) therefore post hoc tests were not completed. Descriptive statistics for the SAFFE questionnaire can be found in Table 4 and 5.

Table 4: Intervention Group: Mean, SD, SE, and Range of SAFFE Questionnaire

	A		**B**		**C**		**D**		**E**	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Mean	9.5	9.6	0.4	0.4	0.5	1.2	0.2	0	2.5	1.8
SD	1.51	1.17	0.55	0.34	0.85	1.03	0.42	0	1.90	1.87
SE	0.48	0.37	0.17	0.11	0.27	0.33	0.13	0	0.60	0.59

Table 5: Control Group: Mean, SD, SE, and Range of SAFFE Questionnaire

	A		**B**		**C**		**D**		**E**	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Mean	9.2	9.4	0.4	0.7	0.9	1.3	0.2	0	2.8	3.2
SD	1.48	1.27	0.31	0.40	1.29	1.25	0.63	0	2.94	2.25
SE	0.47	0.40	0.10	0.13	0.41	0.40	0.20	0	0.93	0.71

POSTURAL SWAY

No significant main effects or interaction effect. All data for these measures are presented in Table 6.

Table 6: Summary of postural sway measures during quiet standing trials. No significant differences were found either between the groups or across the pre and post testing conditions. See text for definitions of all measures.

Measure	Control Pre	Control Post	Intervention Pre	Intervention Post
CoP Total Length (EO)	53.69 (±18.98)	50.97 (±16.90)	50.94 (±18.98)	51.50 (±10.12)
CoP Length X (EO)	41.77 (±16.49)	37.37 (±12.05)	36.35 (±10.71)	39.09 (±9.09)
CoP Length Y (EO)	25.24 (±8.04)	26.67 (±11.16)	27.85 (±6.38)	25.63 (±5.16)
CoP Range X (EO)	2.10 (±.53)	2.60 (±0.65)	2.45 (±0.44)	2.86 (±0.54)
CoP Range Y (EO)	2.72 (±0.93)	2.81 (±1.67)	3.04 (±0.80)	2.47 (±0.40)
CoP SD X (EO)	0.57 (±0.10)	0.48 (±0.11)	0.47 (±0.08)	0.54 (±0.12)
CoP SD Y (EO)	0.55 (±0.24)	0.57 (±0.34)	0.57 (±0.11)	0.47 (0.10)
CoP Velocity X (EO)	0.0004 (±0.0003)	0.00032 (±0.0002)	0.0003 (±0.0002)	0.0003 (±0.0001)
CoP Velocity Y (EO)	0.0001 (±0.00001)	0.0002 (±0.0001)	0.0002 (±0.0001)	0.0002 (±0.0001)
CoP Linear Velocity (EO)	1.85 (±0.65)	1.76 (±0.58)	1.76 (±0.39)	1.77 (±0.34)
CoP RMS X (EO)	0.011 (±0.002)	0.009 (±0.002)	0.009 (±0.001)	0.01 (±0.002)
CoP RMS Y (EO)	0.010 (±0.004)	0.01 (±0.006)	0.010 (±0.002)	0.009 (0.002)
CoP RMS (EO)	0.015 (±0.004)	0.014 (±0.006)	0.014 (±0.002)	0.014 (±0.002)
CoP Total Length (EC)	75.27 (±32.59)	70.6 (±30.56)	70.84 (±22.68)	74.97 (±28.27)
CoP Length X (EC)	62.99 (±31.44)	56.78 (±24.4)	55.17 (±21.61)	63.20 (±26.91)
CoP Length Y (EC)	29.08 (±9.59)	30.48 (±15.69)	33.16 (±8.08)	28.77 (±8.15)
CoP Range X (EC)	3.74 (±0.95)	3.24 (±0.87)	3.57 (±0.70)	3.56 (0.81)
CoP Range Y (EC)	3.41 (±1.68)	3.16 (±2.16)	3.09 (±0.86)	2.51 (±0.62)
CoP SD X (EC)	0.71 (±0.17)	0.61 (±0.17)	0.65 (±0.13)	0.66 (±0.14)
CoP SD Y (EC)	0.70 (±0.35)	0.64 (±0.45)	0.59 (±0.18)	0.48 (±0.12)
CoP Velocity X (EC)	0.001 (±0.001)	0.0008 (±0.0006)	0.0007 (±0.0006)	0.001 (±0.0008)
CoP Velocity Y (EC)	0.0002 (±0.0001)	0.0002 (±0.0002)	0.0002 (±0.0001)	0.0002 (±0.0001)
CoP Linear Velocity (EC)	2.59 (±1.12)	2.43 (±1.05)	2.44 (±0.78)	2.58 (±0.97)
CoP RMS X (EC)	0.013 (±0.003)	0.011 (±0.003)	0.012 (±0.002)	0.012 (±0.003)
CoP RMS Y (EC)	0.013 (0.007)	0.012 (±0.008)	0.011 (±0.003)	0.009 (±0.002)
CoP RMS (EC)	0.019 (±0.006)	0.017 (±0.008)	0.017 (±0.002)	0.016 (±0.003)

TUG TEST

There was no significant difference found between the intervention and control groups ($F_{(3,34)} = 0.37$, $p > .05$) scores after a 2-way ANOVA was completed. The intervention and controls both showed slight increases in TUG test times from pre-test to

post-test as seen in Table 7. A score of 10 seconds and below indicates the older adult is freely mobile. Both the pre-test (M = 9.6, SD = 1.83, SE = 0.58) and post-test (M = 10.0, SD = 2.22, SE = 0.70) times for the intervention group were below 10 seconds which indicates the intervention group were freely mobile before and after the 10-week exercise program. The same was true for the control group, both the pre-test (M = 9.1, SD = 1.59, SE = 0.53) and post-test (M = 9.5, SD = 1.93, SE = 0.64) times were below 10 seconds. Descriptive statistics for both the intervention and control groups are shown in Table 7.

Table 7: Timed Up & Go Test Mean, SD, SE, and Range

	Intervention		**Control**	
	Pre-Test	***Post-Test***	***Pre-Test***	***Post-Test***
Mean	9.6	10.0	9.1	9.5
SD	1.83	2.22	1.59	1.93
SE	0.58	0.70	0.53	0.64

FOAM AND DOME TEST

The foam and dome balance assessment had 6 conditions that were scored individually. There was no significant difference ($p > .05$) found between the intervention and control groups for the 6 conditions. The descriptive statistics can be found in Table 8 and 9.

Table 8: Intervention Group Foam and Dome Test

	EOFL		**ECFL**		**DFL**		**EOFo**		**ECFo**		**DFo**	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Mean	90	90	90	90	90	90	90	90	73.8	84.1	70.2	84.6
SD	0	0	0	0	0	0	0	0	34.46	18.66	36.89	14.50

Table 9: Control Group Foam and Dome Test

	EOFL		**ECFL**		**DFL**		**EOFo**		**ECFo**		**DFo**	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Mean	90	90	90	90	90	90	90	90	85.6	90.0	87.2	90
SD	0	0	0	0	0	0	0	0	9.20	0	8.33	0

CHAPTER FIVE
QUALITATIVE RESULTS

Following an inductive analysis, five themes emerged from the focus groups: awareness, confidence, quality of health, connectedness, and promotion. These themes illustrate the impact the program had on the perception of the older adults personal fall risk and how the older adults identified with the program. The five themes are described using comments from participants to offer further understanding about their perceptions. Sample participant comments are represented in italicized text throughout the paper. Upon individual analysis of the intervention and control focus group results, it was clear that there were considerable similarity between the stories that both groups were telling. As such the decision was made to combine both of the focus group results to analyze and discuss as a whole. Despite these similarities between the information gathered from the two focus groups, there were some slight differences. These differences are highlighted in a section of the Discussion that has been devoted to examining responses of the two focus groups separately.

RISK FACTOR AWARENESS

The first theme that emerged from the focus group transcripts was risk factor awareness. The concept of awareness generally refers to becoming aware of having knowledge of a concept or event. Participants referred to many factors within the education session that helped them understand certain risk factors and that became evident as they shared incidents from their own lived experiences. The participants mentioned several risk factors that were organized into two categories: environmental and personal risk factors.

ENVIRONMENTAL RISK FACTORS

A fall can occur from obstacles in the outside environment as well as items in the older adults' home. Participants became aware of these environmental risk factors during the education session through others sharing their fall stories and through the material presented. The environmental risk factors discussed included: ice, stairs, walkways, bathtubs, mats, ladders, lack of lighting, and being out at night. Participants admitted that environmental risk factors, especially ice, hinder their socialization. A participant stated:

> *I would say for me at nighttime if it's slippery or something I'll hesitate about going somewhere at night and I never used to be like that. I'm very wary about going out when it's dark and slippery and I scuff on ice. I never did that before.*

During the education session, the older adults were enlightened about risk factors that may be in their homes. For many individuals at the session, this discussion created awareness because they were not cognizant that basic items, such as lighting, could be hazards. One participant mentioned the education session made her more cautious and has changed her behavior:

> *I find what this program has done for me too it has made me more conscious of falling. It was never in my mind before but now when I go to the top of the stairs I make sure the light is on or if there's something on the floor I'll make sure I take my time.*

A daily chore in the home that could be considered risky is doing laundry. Many of the participants had not even considered that how they did their laundry could increase fall risk. Carrying a laundry basket up and down the stairs diminishes the visual pathway and foot placement cannot be seen. This was mentioned in the education session and during the focus group it was also a topic of conversation. One participant stated:

> *I was bad for going up and down stairs carrying baskets of clothes. I used to take the shortcut so now I'm more into throwing the clothes down over the stairs and when I'm ready I go down and that's it.*

This participant made a behavior change and now throws her clothes down the stairs instead of carrying a basket. This is a simple modification but it will decrease fall risk.

PERSONAL RISK FACTORS

It was evident to participants once they began the fall prevention program that falls can happen as a result of personal choices. Personal fall risk factors include multi-tasking, rushing, and footwear. A participant shared a fall experience that was triggered by doing too many tasks at a time and is an example of how multitasking can cause older adults' attention to be divided resulting in a fall.

> *I had fallen a couple of times before this happened but you know why I fell because I was trying to do 2 or 3 different things at the same time and not being careful. But now I find that I'm inclined to watch it as I carry a laundry basket up and down the stairs or I get the right thing to stand on if I'm reaching up.*

The participant made the fall a learning experience and has decided to slow down so another fall does not occur. The fall experience created awareness and the participant has learned to change her behavior. Another participant shared a fall experience that she did not realize the cause of until after the education session.

> *I fell the other day. It was because I was rushing. I didn't realize that until we had done that seminar here and I know it was my own fault. I was rushing out the door and I tripped and fell on my knees on the patio. It's now making me more aware.*

By attending the education session this particular older adult gained awareness and insight into why she fell. Now she can make a behavior change to ensure another fall does not occur for the same reason.

CONFIDENCE

Confidence was another theme developed from the focus groups. The participants believed they gained confidence over the course of the fall prevention program by

recognizing their exercise abilities and improvements in their daily living activities. With the increased confidence came a decrease in fear of falling as well as a decrease in activity restriction.

Many of the older adults described how their level of confidence in their own abilities was improved as a result of the program. The participants became aware that they still had the ability to complete various exercises that they have not attempted in years:

I didn't even know I could do it. It has been 50 or 55 years for sure.

Reasons for the lack of exercise ranged from not having time to believing they were too old for certain activities such as playing badminton.

Other participants observed increased physical abilities as the 10-week program progressed. Seeing the personal improvements was a great motivator for the participants to keep attending the program. There were minor changes such as flexibility:

I can touch my toes now and I couldn't do that before I came here.

There were also larger improvements such as managing arthritis:

> *I know I have benefitted from it just arthritis wise because the arthritis is severe but it's not dominating my every day because this program had changed my perception you know of not letting it control me, I'm controlling it now more so.*

No matter how small an improvement, the participants gained confidence from the changes. The improvements are helpful for older adults in their daily lives:

> *But I find the program has helped me a lot. I used to always have to hold onto the bureau to put on my slacks now I'm able to put my slacks on without holding onto anything.*

As confidence increased, the participants' fears began to decrease. The confidence gained by the older adults brought realization that they did not have to be afraid of certain obstacles such as going out at night. The renewed confidence also gave the older adults the

insight that they are not afraid of exercise and they feel the need to continue to exercise so they can have longevity in life.

> *I thoroughly enjoyed the program and it has given me a lot more self-confidence then I had because I had a knee replacement and I always had a fear of falling, tripping over a mat, tripping over my shadow. But I find that I've gotten a lot out of it and I enjoyed it.*

> *I've had some serious leg problems and even though I am still conscious of those things, I've learned to let go a little bit of my fears through this.*

It is a distinct possibility that the participants renewed confidence will carry over into many aspects of their life including their relationships and quality of life.

CONNECTEDNESS

Connectedness emerged as a major theme. The term connectedness refers to the social interaction the participants gained and relied on as motivation to attend the program. Two categories emerged from this theme: social interaction and self. It was clear that not only did the older adults gain social interaction from each other but the relationship with the instructors was important as well. The 'self' category developed as the older adults expressed that participating in the program for them was an important component.

SOCIAL INTERACTION

The social aspect of the program was a major component for many of the older adults. The majority of the participants were retired and mentioned they do not receive the social interaction they once had while working. This program was beneficial for them to meet new people and to engage in a social setting.

> *I enjoy meeting people. I wouldn't go by myself and you wouldn't go every time you were supposed to go but if you know you see people and enjoy it and have a laugh you are more inclined to go.*

It was clear that going to a fitness center for exercise was not the ideal for these participants. Participants explained that the fitness center lacked the feeling of connectedness they gained while engaged in the program.

> *We could exercise at home but we don't. But when you get in a sociable group like this it makes it fun to exercise and you're not like you're in the gym. This is the perfect place.*

The participants related to one another as a group. When the program ended, the older adults planned to continue meeting weekly whether it was for exercise or to go for breakfast. This supports the strength of the bond they developed.

> *I'm sure if you went all over Conception Bay you couldn't have found a more compatible group. We were all on the same page. Everybody is pleasant and it was a good experience.*

Connecting with the instructors was also important to the participants. Besides the typical instructor qualities such as motivation, encouragement and patience, the participants enjoyed laughing and interacting with the instructors.

> *The attitude of the young instructors we had. They certainly really encouraged us to come and challenged us. There was no impatience with us.*
>
> *And they could laugh with us.*

The connectedness with the instructors is not an experience the participants would gain if they exercised at home or at a fitness center. The qualities of an instructor the participants valued included confidence, knowledge and a sense of humor. The older adults wanted to be able to laugh with the instructors and be able to relate to them. Participants were asked if there were qualities they found undesirable in instructors they had in the past; they listed the following qualities: overly chatty, self-involved, someone who compares the participants, and a 'know-it-all' attitude.

SELF

The second category that characterizes the connectedness theme was having a connection to the self. Participants explained they often get so caught up with meeting everyone else's needs that their own needs are a low priority. This results in them neglecting their own health and well-being. Many of the older adults involved in the program were also volunteers for other groups such as churches and town councils. Their time was spread very thin between volunteer obligations and their families; time for the self was lost.

> *First when I retired which is what 20 odd years ago now, I was involved with a lot of things and I used to go swimming once or twice a week. Then after my husband retired I was chasing him here and there so we were going together places and I just got out of this kind of thing.*
>
> *When I leave here I have a volunteer thing to do but this is for me.*

Many of the barriers the participants faced when attending the classes were family related. Taking care of grandchildren was a major factor as well as caring for a spouse. Often the reason for absence was not for personal reasons but due to a family member. Attending the program allowed the participants to care for their own needs and focus on the self instead of others.

QUALITY OF LIFE

The next theme that materialized from the focus groups was quality of life. Once participants began to realize the benefits that the exercises were having they began to appreciate the importance of a healthy lifestyle. They realized that in order to maintain a good quality of life, they needed to be involved in physical activity and be mindful of healthy eating in order to sustain an independent lifestyle and ensure longevity.

The main draw to the program for many of the participants was the idea of exercise. Throughout the 10-week program a variety of exercises were presented to the participants. One participant shared a memory of when she realized that she needed to lose weight.

> *The exercise I found that made me think I really need to get this weight off was the simplest one, the two feet together and jumping over the little line. That was probably the hardest exercise and it made me stop and think that's because I got the weight on, I got to start doing something about that as well so I have to eat healthier. But just little exercises like that made you stop and think about how you have to change your lifestyle so there were a lot of eye openers in those exercises.*

The participant was surprised when she thought the exercise would be simple and she found it the most challenging. She took this eye opening experience and turned it into a positive experience by making a life change to eat healthier and to decrease her body weight.

The main focus of the exercise program was to improve the balance of the older adults. Older adults may not realize their balance deteriorates with age, as clearly articulated by participants in this study. Many of the participants in the focus groups described how they were shocked when their balance was put to the test and they struggled with the assessment. One participant stated,

> *I think that initial assessment told me my balance wasn't great.*

The exercises given to the participants made them realize their balance was not what they expected and they needed to be able to improve to maintain their quality of life. A fall will be less likely to occur if older adults are aware of their lack of balance while out in the environment and they will be more conscious of their surroundings.

> *You are not aware that you have such a lack of balance until we did this program. Like I didn't realize how off my balance was but when I compare my balance now to when I first started it's a big difference. So if we don't have something to keep this up then this is a lost cause. We need something so that we will continue to maintain that balance we are never going to do that at home because something else takes over.*

By completing this program, participants came to understand that exercising and improving balance can aid in their health and quality of life. Some of the older adults described how they changed. Some participants changed their eating habits and committed themselves to lose weight in order to maintain and improve their health. The older adults recognized they need a fall prevention program to decrease their likelihood of falling,

> *This program especially for women at our age prone to hip fractures and breaks and everything you know this could prolong your life.*

The participants want to maintain their independent lifestyle. In order for that to occur, they see the need for a program to be put in place.

> *It could prolong your life and probably not end up an invalid and end up in a home where you have to be looked after. So there are a lot of benefits from it.*

> *Just doing those little exercises (balance assessments) they are so easy but I can't do some of them because I don't have the balance. I didn't realize it was bad, it was worse than I thought.*

The fall prevention program not only assisted the participants with their health but also made them realize the importance of exercise programs to ensure they live a long and healthy life.

PROGRAM PROMOTION

During the focus groups there were questions asked about how participants came to learn about the program, the methods to recruit future participants and barriers the older adults faced in attending the classes. The participants mentioned many issues and offered suggestions regarding promotion that are organized into three categories: advertisement, recruitment, and scheduling. The theme of promotion provides further understanding about the older adults' perceptions of the program.

ADVERTISEMENT

The fall prevention program was advertised in the community newsletter that is distributed monthly. The participants shared constructive criticism about ways to improve upon this advertisement such as providing more of an explanation about what the program offered. There was limited wording in the advertisement, just enough to peak their interest to attend the information session prior to the start of the first exercise class. Words that caught the eye of the participants were “fall” and “fall prevention”.

> *I'll tell you what attracted me was the “prevent falling” and I knew at my age now I was prone to falling and it was what attracted me. I could go somewhere and learn something about how not to fall and break my hip.*

These words were enough to spark the curiosity of the older adults to drive them to attend the information session where they learned exactly what the program entailed. However, the wording of the advertisement also confused others. One participant stated,

> *One lady said to me she didn’t realize (it was an exercise program) she thought it was about learning how to fall.*

This woman decided not to attend the information session because she thought the program was about learning to fall and was not interested. If she knew it was an exercise program she would have been more inclined to attend. Other participants heard about the program through word of mouth around the community of Holyrood,

> *I’m not from Holyrood but my cousin’s wife told me about the program and thought I might be interested and I’m so happy she did because it was wonderful.*

These participants missed the advertisement either because they lived outside the community or the advertisement was too small in the newsletter.

RECRUITMENT

The older adults offered suggestions of methods to recruit future participants. The main method talked about was to approach seniors groups in desired communities. Older

adults willing to participate in activities are likely to be a member of a seniors group already. Promoting programs in community newsletters is also a viable option, especially given that this method was effective for the present program.

The participants in this program were mostly women and there was a discussion around the recruitment of men. Many of the women believed that men deny they are aging and therefore are unwilling to participate. Another woman stated,

> *Men don't fall like women do. They're not prone to falls because their bones are stronger and they have more balance, as they get older.*

This comment suggests that women may also believe that men have a slower aging process and may not need a program to decrease their fall risk. Therefore, future recruitment should emphasize the need for men to also get involved in order for them to gain the benefits that the women saw throughout the fall prevention program.

SCHEDULING

The participants also offered insight about scheduling of the classes as well as the barriers they faced attending classes twice a week. Time of day was a major factor for the older adults and many found a morning session was beneficial,

> *I found the time good. 10:30 in the morning you could get stuff done before and you were home before lunch so I think the time was a nice time. And then you had your whole day ahead of you.*

It was discovered that a 60-minute session was preferred,

> *I think at our age our attention span is only good for 45 minutes to an hour.*

The participants also listed a variety of attendance barriers including going to a doctor appointment, babysitting grandchildren, and caretaking for a sick or injured family member.

CHAPTER SIX
DISCUSSION

INTRODUCTION

Falls in older adults are multifactorial in nature. Although most individuals over the age of 65 are at increased risk for falling, the factors underlying this heightened risk can be numerous and varied. During the 10-week fall prevention program the intrinsic factor, balance deficit, was addressed by implementing a balance-training program that introduced stepping strategies, reducing base of support on compliant surfaces, and producing perturbations. These exercises also assisted with muscle strength by using weighted objects and completing leg-strengthening exercises. The extrinsic factors were addressed during an education session that highlighted many environmental and lifestyle risk factors. Suggestions were given to the participants on methods to reduce risk factors in and around their home as well as new techniques to complete activities of daily living that will decrease the likelihood of a fall occurring.

Given the multitude of factors known to contribute to increased fall risk, there is no one test or assessment tool that can be used to determine whether an individual is at increased risk of falling or whether an intervention has resulted in decreased fall risk. In the present study a combination of quantitative and qualitative methods were used in an effort to gauge the effectiveness of the fall prevention program. Despite excellent adherence to the program, results from all quantitative measures used suggested the program did not significantly improve participants' balance nor did it result in any changes in falls efficacy, exercise efficacy, or balance confidence. Contrary to this lack of positive effect on quantitatively measured variables, the qualitative analysis that was completed suggested the program had many positive benefits for participants and resulted in improved risk factor

awareness, social interactions, overall confidence, and quality of life. The participants had a strong attachment to this program and saw personal improvements throughout the 10-weeks. The perceived benefits of the program seemed to outweigh the measured variables from the participant's perspective.

QUANTITATIVE DATA

This study employed a set of quantitative outcome measures commonly used in studies examining fall risk in older adults that are both valid and reliable (Cabrera et al., 2011, Clark et al., 2010, Cohen et al., 1993, Lachman et al., 1998, Powell & Myers, 1995, Shumway-Cook et al., 2000). Despite this, participants demonstrated no significant improvements in any of these areas following the 10-week training program. While an obvious conclusion based on these finding would be that the program had no effect, both the qualitative data from this study and the discussion below suggests otherwise.

Why then, were there no measureable changes in the quantitative variables examined in this study? Based on a review of the literature it is felt that the extremely high level of function of all participants in the study led to a ceiling effect. A ceiling effect is when an assessment is too easy and may mask balance deficits in high functioning community-dwelling older adults (Balasubramanian, 2015). In a study completed by Boulgarides et al. (2003) it was found that five assessments (Berg Balance Scale (BBS), Dynamic Gait Index (DGI), TUG Test, Modified Clinical Tests of Sensory Interaction for Balance, and 100% limits of stability test) could not predict falls in a sample of high functioning, independent older adults. In Boulgarides' research, subjects completed the assessments and were then tracked for 12 months to assess the number of falls that occurred. Over the course of one year, 42 participants out of the 99 that completed the

study experienced one or more falls. Boulgarides et al. (2003) found that many of the participants that fell scored well on the balance assessments. For example, one subject scored 55/56 on the BBS but fell nine times in 12 months. Boulgarides et al. (2003) concluded that the above mentioned balance assessments were not suitable to assess high functioning older adults. Pardasaney, Latham, Jette et al. (2012) also completed a study on assessing the ceiling effect of 4 balance measures (BBS, DGI, Performance-Oriented Mobility Assessment, and Short Physical Performance Battery (SPPB)) in community-dwelling older adults. Similar results were found in that these assessments could not predict falls in the sample population. We feel that this same ceiling effect was evident in the 10-week fall prevention program carried out for this research. For example, during the Foam and Dome pre-test, the majority of the participants were able to complete the test on the first attempt for all six conditions. Therefore, there was no room for improvement on the post-test. Similarly there was no improvement seen in the TUG scores from pre-test to post-test. According to Podsiadlo & Richardson (1991) TUG scores below 10 seconds suggest the participant is freely mobile and less than 20 seconds suggests mostly independent. The majority of participants had scores below 10 seconds on the pre-test and the remaining participants were below 15 seconds.

If data collection for this study had been limited to these quantitative measures then the likely conclusion of this research would have been the program did not improve static/dynamic balance, had no impact on falls efficacy, balance confidence, and exercise efficacy. As stated above, this was likely due to the very high level of function in the study participants. The inclusion of focus group data however enabled closer examination of the

personal impact of the study on participants' lives. It was at this level of analysis that the true benefits of this program were demonstrated.

QUALITATIVE DATA

While fall risk in older adults and fall prevention programs have received considerable attention from the research community, the present research represents one of the first studies to examine an intervention program using a qualitative approach. Similarly it represents the first time focus groups have been used to delve more deeply into the perceptions and beliefs of older adults living in NL as they relate to their fall risk and fall prevention programming in general. It was determined that understanding the views and perceptions of the participants involved in the fall prevention program was important for future programming. Older adults are the target market for fall prevention therefore programs should be designed with this age group in mind. In order to design a program that will attract older adults it is crucial to understand what they know about fall risk and prevention as well as what a program should offer that would make them interested to attend. The participants' perception of the fall prevention program suggest the program was a success in raising risk factor awareness, increasing confidence within the participants, creating connectedness among the participants and instructors, encouraging the desire to live a better quality of life, and gaining interest though program promotion. These themes identified from the qualitative data embody the participants' opinions and experiences throughout the program.

RISK FACTOR AWARENESS

Risk factor awareness is an important piece of fall prevention programming since it educates the participants about their surroundings and necessary changes that will reduce

their fall risk. During the focus group discussion the participants were given the opportunity to share their own fall experiences with the group. It was important for the participants to hear others experiences so they could understand that a fall can occur in a variety of situations and with any age and ability.

It is common for older adults to ignore risk factor information since many believe the information does not apply to them if they are in denial about their capabilities (Yardley et al., 2006). On the other hand, older adults may be aware of the risk but reject the information publicly to ensure others perceive them as independent. A study completed by Tinetti, Baker, McAvay et al. (1994) found that the control group saw an improvement in fall reduction as well as the intervention group. The control group received information about risk factor awareness, which shows that educating older adults on fall risk may be enough to reduce the number of falls. In a qualitative study completed by Yardley et al. (2006) participants stated that informing older adults of their fall risk is necessary to remind them of the role of aging and the need to adjust their activities. Participants in the Yardley et al. (2006) study also stated that fall prevention material reduces anxiety and fear surrounding falls. The participants in this fall prevention program had the same thought surrounding the fall risk information they received during the education session. Many admitted during the focus groups to making behavior changes based on the information they received during the education session. Fall risk factors mentioned were laundry, lighting, and footwear. However, Yardley et al. (2006) found it was common for the participants to express that the information may not be necessary for themselves but useful for other individuals that needed it. Their perceptions imply they felt they were simply too young or more fit than others to need or make use of the information. Yardley et al. (2006)

stated that the majority of their participants were aware of the risk and consequences of falling but refused to define themselves as potential fallers. One participant in our fall prevention program spoke of the education session and advice they were given on safer methods to do laundry. One method described to the participants was to use a laundry bag and to throw it down the stairs instead of carrying a basket that will obstruct their vision. A participant stated, "They are excellent, I bought them for all of my sisters." Based on this quote it is not clear if the participant applied the laundry method to her daily routine or whether she saw the risk for her sisters and provided them a tool to reduce their fall risk. This example supports the conclusion made by Yardley et al. (2006), that older adults can more easily see the risk in others than in themselves.

With the exception of the one comment highlighted above, most of the information gathered from our focus group sessions suggested that participants were very welcoming of the discussion surrounding fall risk and found the conversation about the risk factors that surround them every day very informative. Unlike participants in the Yardley et al. (2006) study, many of our participants were eager to learn about risk factors and make the appropriate adjustments to ensure safety when completing activities of daily living. Not only did the participants acknowledge the environmental risk factors that exist, they were also able to take the education session information and apply it in a preventive way by making personal behavioral adjustments. During the focus group there was discussion around behavior change where one participant stated:

> *The program has made me more conscious of falling. It was never on my mind before but now when I go to the top of the stairs I make sure the light is on or if there's something on the floor I'll make sure I take my time.*

The conscious decision made by this participant speaks to the importance of the education piece of a fall prevention program. These lifestyle choices would not be seen in the objective balance measures but may help to decrease fall risk. These findings may represent a fundamental difference in the experience of NL older adults as compared to those in the Yardley et al. (2006) study. These differences may possibly be owing to cultural, socio-economic or geographical factors. Further research, in the form of both survey and focus group sessions, is being designed to examine this issue more closely in an effort to determine if similar feelings are expressed by a broader sample of NL older adults.

Another qualitative study that addressed the importance of risk awareness education investigated a clinic's impact on empowering individuals living with rheumatoid arthritis. Arvidsson, Petersson, Nilsson et al. (2006) discovered that bringing awareness to the patients about their own care and treatment gives the patient control over their disease. The researchers realized that patients became empowered when they gained the self-awareness to influence their own behavior. The same can be said for the participants in this fall prevention program study. The awareness gained by the participants about the fall risks that surround them positively influenced their behaviors related to fall risk. The fall prevention program provided participants with the knowledge for reducing risk factors within their home and the awareness to observe and avoid risk factors in the external environment. While outside the scope of this study, as Tinetti et al. (1994) suggest, the information the participants received surrounding risk factors may have a significant impact on reducing falls.

Responses from the focus group participants clearly demonstrated that the exercise program and education session created awareness about a variety of fall risk factors both

environmental and personal. Participants now have a different perception of their surroundings and an improved ability to identify fall risk factors to either avoid or eliminate the risk. The education the participants received on fall risk factors may help reduce future falls. The fall prevention program not only helped to create risk factor awareness, it also positively impacted the participants' confidence level by reducing their fear of falling and improving upon their physical capabilities.

CONFIDENCE

During the focus group discussions the participants spoke about their abilities throughout the 10-week exercise program and how this impacted their lifestyle. It is common among older adults to develop a fear of falling after a fall occurs (Tinetti et al., 1994), but such fear can also be present without a fall history (Vellas et al., 1997). Activity restriction and avoidance is a common result of developing a fear of falling (Delbaere et al., 2004, Yardley et al., 2006), which often leads to a decline in physical capabilities (Arfken et al., 1994). One method to reduce fear of falling in older adults is to increase confidence in their abilities, thereby decreasing the likelihood of activity restriction and eventual physical deterioration. The theme of confidence in our study depicts the idea that gaining confidence would allow participants to maintain a healthy active lifestyle by giving them the motivation and ability to maintain exercise after the program is complete.

Older adults develop a fear of falling due to being afraid of the consequences of falling which can negatively impact their self-confidence and self-image and result in activity restriction (Yardley et al., 2006). A stronger level of self-confidence in their physical capabilities seems to decrease individuals fear and they no longer feel the need to restrict activity. Yardley & Smith (2002) found that loss of confidence in balance capabilities is a predictor of eventual activity restriction and deterioration of physical

function. This suggests that it is necessary to instill balance confidence within older adults to ensure physical deterioration does not occur. Data gathered from the current fall prevention program provides evidence that the fall prevention program used can provide confidence for older adults.

Lack of confidence to join and participate in programs and activities is a barrier for many older adults as McInnis & Askie (2004) highlighted in their literature review of the views and preferences of older adults on fall prevention programs. In this review it was revealed that older adults are reluctant to join a fall prevention program with an exercise component if they have not previously exercised. While not part of the formal data collection and analysis for the current fall prevention study, I observed behavior from one participant in the control group that suggests lack of confidence was present. The participant was adamant that she did not have the ability to complete the pre-test measures which involved the TUG test, foam and dome, and postural sway. She decided to attempt the measures and she was shocked at how much she was able accomplish. The participant left with a sense of renewed confidence. Unfortunately when the participant returned for follow-up testing she felt she was unable to complete the balance assessments, choosing instead to only complete the questionnaire portion. While is it impossible to know why, certainly a lack of confidence in her physical abilities appeared to be a determining factor in this individuals unwillingness to complete the post-tests. This serves as a very stark example of the negative effect of lack of confidence on program participation.

One way to overcome the barrier of lack of confidence may be for older adults to hear testimonials from others who have participated in programs and experienced the benefits. As one participant stated,

> *Once you retire you're away from the workplace, your social skills are not the same so to get involved with something like this is wonderful. The exercise is great but the social part is wonderful as well.*

Highlighting testimonials from other studies could also be helpful. For example, Dickinson et al. (2011) explored the perceptions of older adults on the facilitators and barriers to participation in fall prevention programs. One participant stated, "I think doing exercise like this helps me. I think it makes me stronger" (Dickenson et al., 2011, p. 177).

Despite the testimonials from participants in our focus groups stating the increased confidence they acquired throughout the program, the quantitative measures told a different story of declining confidence from pre-test to post-test. One possible explanation for the discrepancy is the participants became more aware of their fall risk and thus became more cautious by the end of the program. Fifty percent of the participants indicated their balance confidence decreased from pre-test to post-test based on the ABC Scale scores. This decrease in balance confidence can be explained by the increase in awareness the participants gained throughout the program. The new found awareness of potential risk factors could have made the participants cautious of their surroundings and aware of the increased potential for a fall to occur. This awareness may have caused the participants to become more realistic in their answers of the post-test questionnaires. The program and the education session gave the participants understanding that some activities they engage in are risky such as climbing on a chair to reach objects or climbing a ladder, which many stated they would eliminate these behaviors to ensure their safety. Prior to the program participants claimed they engaged in these risky behaviors without hesitation whereas at the end of the program they gave it more consideration. Despite this hesitation, however, it was clear through the focus group discussions that participants' confidence in their abilities to

do their regular daily activities as well as their confidence in their ability to exercise was positively impacted by the program. These findings speak to the importance of combining quantitative and qualitative data in research such as this.

In addition to improved confidence levels, participants also reported gaining insight in to their exercise ability. Most of the participants had never participated in a program with this type of structure and were cautious of the exercises presented to them. As the program progressed the instructors could see the confidence beginning to develop within the participants as they attempted new exercises without hesitation. The newfound confidence was evident when the participants started asking the instructors to enhance the exercises to provide more of a challenge. Once the participants realized they had the ability or developed the ability to complete many of the exercises they wanted a new challenge to improve their skills. Exercises that were once daunting to many at the start of the program became second nature to the participants. The same can be said for the participants' in the Dickinson et al. (2011) study. The researchers discovered that participants' were more likely to attend class if the activity was at an appropriate level for their ability.

As confidence in the participants increased their fear began to decrease. The participants welcomed new exercises and appreciated the challenge instead of shying away from them because they were unsure if they had the ability. The reduction in fear also decreased activity restriction. The 10-week program introduced new activities and revitalized old ones that the participants had not attempted in years such as hoola hooping. Giving the participants the opportunity to attempt old skills helped them realize that they were not "too old" to still complete many activities. This realization may reduce their activity restriction and instill confidence to try new activities or pick up old ones.

At the end of the 10-week fall prevention program the participants spoke about the improvements they saw within themselves. For one participant, she realized her flexibility improved and she now had the ability to touch her toes. Another participant had arthritis that prevented her from doing many activities and now that she was exercising regularly she was able to manage her arthritis better. One participant spoke about her fear of falling that she had prior to the program and how she is now able to let go of her fear and not feel the need to restrict her activities as she once did.

The participants' realization of ability and their personal improvements resulted in a positive attitude about the program and exercising in general. The positive attitude and gain in confidence may encourage these older adults to participate in other programs in the future and/or to continue exercising. This perceived increase in confidence may allow the participants to continue to exercise and lead a healthier lifestyle to give them independence and longevity in life.

CONNECTEDNESS

For participants to be more likely to benefit from the information and activities provided in the fall prevention program, it was important for them to feel a sense of belonging and connectedness. Previous literature has identified that perceived social support appears to be a significant factor associated with exercise behavior in older adults (Chogahara, 1999; Courneya & McAuley, 1995; King, Taylor, Haskell et al., 1990). The participants in this study highlighted the importance of support from their instructors but also the social support from other participants. Not only was this important for participants for program adherence, but it was a major contributing factor for enjoyment and gaining confidence.

Based on the focus group discussions it seems a major motivator for attendance and adherence for the fall prevention program was the relationships established with the other participants and instructors. This is supported by Schoster et al. (2005) in a study with participants in an arthritis exercise program. One participant in the Schoster et al. (2005) study stated, "Yeah, I'm much more likely to exercise if I've got motivation like that. Okay, the rest of the crowd's comin', I better go, too. And that way you get to visit with everybody, too." For many of the participants, the arthritis program was a social outlet since they lived alone due to loss of a spouse or their children lived away. Similarly, the fall prevention program offered the participants the opportunity to meet new people and engage in a different social setting than they were used to. As the 10-week program progressed, the participants connected very well as a group and formed new friendships. Initially the participants were there to exercise and to learn about fall prevention, but by the end of the program it appeared the social aspect gained greater importance than the physical benefits.

Based on the focus group discussions, it was evident that the social connection between participants played a significant role in participants' strong dedication to the program. It is clear that people's motivation to participate may be more closely tied to social connectedness rather than their presumed motivation to improve objective measures. As such, it is important to consider how much perceived self-confidence in ability to complete exercise and activities of daily living is intertwined with social connectedness. McAuley et al. (2003) reported that older adults who perceived the group to provide greater support had stronger self-confidence and stated exercise made them feel better. Enjoying the physical activity experience and feeling good plays a direct role in maintenance of exercise over time (McAuley et al., 2003). Resnick et al. (2002) also found similar results

in that friend support had statistically significant effect on self-efficacy expectations, which influenced exercise behavior.

Participants in this fall prevention program indicated that the relationships established with the instructors were just as important as their relationships with each other. It was clear from the participants that they wanted knowledgeable and reliable instructors with expertise to guide them through the program but it was just as important that they could relate to instructors on a personal level. Van Stralen et al. (2009) also studied the relationships with instructors and found a positive association between sustained physical activity for over six months and social support from an instructor. Thus, instructor support is an important consideration and future programs need to ensure that the instructors are relatable as well as knowledgeable to increase the likelihood of participant connection to the program.

Another important aspect of the focus group discussions was the concept of connection to the self. Participants realized that the majority of their time was spent on the needs of family and friends instead of taking care of themselves and attending to their own needs. Research indicates that women with multiple roles often put the needs of others ahead of their own (Barnett, 2004, Brooks, 1978). It has become the social norm for women to balance multiple roles concurrently such as work life, domestic responsibilities, and a social life (Sumra & Schillaci, 2015). The idea of being able to do it all can become stressful. Sumra & Schillaci (2015) found a significant negative relationship between the number of roles and exercise frequency in women and determined that exercise frequency had the highest negative correlation with stress. Based on the work of Sumra & Schillaci (2015) it seems that one way for women to manage these multiple roles and the stress

attached to that social expectation is to participate in exercise. Participants in this fall prevention study appeared to find it easier to value focusing on their own health within this health promotion program then they normally would in their everyday life. Participating in an exercise program is not only important to ensure individuals are healthy enough to care for others but it also important to maintain their own quality of life.

QUALITY OF LIFE

The theme of quality of life was an encouraging result of the fall prevention program. A high quality of life means individuals feel better, function better on a daily basis, and for most, live independently (Elavsky et al., 2005, Spirduso & Cronin, 2001). Quality of life is subjective and how an individual interprets what is important to them depends on where they are in their stage of life. For these participants, quality of life reflects a desire to maintain independence and accomplish activities of daily living with ease. The fall prevention program made them aware that exercise and maintaining balance were important to reach that goal. As confidence increased within the participants so did the realization that lifestyle changes needed to be made to ensure quality of life.

The desire to maintain an independent and healthy lifestyle has been discovered in other areas of the health sector besides fall prevention. Wilson, Ross, Goodridge et al. (2008) conducted a qualitative study on the care needs and priorities of individuals living with Chronic Obstructive Pulmonary Disease (COPD), which clearly identified a strong desire by participants to maintain an independent lifestyle. The participants in the fall prevention program share the same notion and reported that it was important for them to reside in their own homes and maintain independence as they age. To some individuals, maintaining an independent lifestyle means retaining their dignity (Woolhead, Calnan, Dieppe et al., 2004). A participant in another study was quoted as saying, “I think if you’ve

been independent all your life, it's an embarrassment to be dependent" (Health Education Board for Scotland 2003, p.27).

While maintaining an independent lifestyle appears to be a key desire of many older individuals research has also found that older adults accept that physical changes are inevitable in later life but there is a belief that they can control what happens to them as they age by remaining physically fit, maintaining a healthy diet, and continuing intellectual stimulation (Minichiello, Browne & Kendig, 2000). Participants in this fall prevention program reported similar views as Minichiello et al. (2000) including one participant's insight that she needed to reduce her body weight when completing what she thought would be a simple task of jumping over a line on the floor. When she found this simple task challenging she realized that she needed to make a lifestyle commitment to eat healthier and to maintain physical activity in order live the life she desired. Maintaining her independence was essential and she believed to reach that goal she needed to make modifications to her lifestyle. Another participant admitted that exercising regularly made her more health conscious and gave her the drive to eat healthier foods. As the fall prevention program progressed over the 10 weeks the participants could see improved physical function through their activities of daily living and realized that certain tasks were becoming easier to accomplish. As their physical function improved so did their feelings of well-being which was evident from the participants expressing the desire to decrease body weight and to improve eating habits. The feelings of well-being in conjunction with the renewed confidence fueled the desire to maintain this lifestyle to ensure a better quality of life.

Quality of life can also be viewed in terms of how people perceive their

management of chronic disease. Research suggests that regular exercise can increase life expectancy by limiting the development and progression of chronic disease (Holloszy, 2000) and disabling conditions (Going, Lohman, Houtkooper et al., 2003). The program participants also had perceptions about their own disease progressions during the 10-week program. One participant spoke of her arthritis and how it once controlled her and typically restricted her activities. Once the program was complete she saw a shift and felt she was the one now in control. Her arthritis was no longer dominating her every day activities. This participant understood that to maintain this control she must continue with regular exercise to prolong the independent lifestyle she desires.

Quality of life can be linked with life satisfaction (Rejeski & Mihalko 2001). These authors reported that for one to be satisfied they must generally have good physical functioning as well as a strong sense of well-being. The participants in the fall prevention program must control their physical disorders, like the arthritis mentioned above, in order to have the physical functioning they desire to maintain independent living and the ability to complete activities of daily living. The older adults' perception of this program was affected by their participation in the exercises and activities in the program. They had multiple reasons for wanting to be involved from maintaining health to losing weight. The participants believed that staying healthy and fit as they age would prolong their life span. The participants felt that the program would help them improve their quality of life and made a conscious decision to apply what they learned from the program to other aspects of their life.

PROGRAM PROMOTION

Uptake and adherence to fall prevention interventions is often poor (Dickinson et al., 2011). Participants' in the current program identified one barrier of up-take is how the

program was advertised. While the print advertisements distributed in the town newsletter were seen by many in the community, focus group participants reported that word choice and lack of detail may have deterred some from attending the information session. However, there were some key words that attracted participants to attend the information session such as “fall” and “preventing falls”. Holding an information session before the program was also had a positive effect on recruitment as it enabled interested parties to gain more insight into what they could expect from the program and to connect with potential future participants. Belza (2007) suggests the same concept of holding group sessions where people can get a “taste” of the program. These findings highlight the importance of paying close attention to program publicity when designing community-based programs such as this. Dickinson et al. (2011) reported that older adults in their study shared similar views to the participants in the current study. Participants in Dickinson’s study were reluctant to partake in the program if there was little knowledge provided about the contents of the program. Yardley & Todd (2005) provided some insight as to the type of information that should be contained in ads and suggested the positive benefits of improving strength and balance were more effective in recruiting participants than messaging that focused on negatives such as fall avoidance. The advertisement used for our study was not worded to highlight the positive benefits and focused more on the reduction of fall risk by engaging in exercise. In the future, wording should be more carefully considered to ensure participants understand the benefits of the program; this could potentially improve interest and attendance in the program.

In addition to the more formal methods of program promotion, participants in the current study also identified ‘word of mouth’ as an important means of encouraging others

to attend the program. At least two participants that would have been unlikely to attend were informed and gained encouragement from friends to join in the program. Participants also spoke of other community members that heard about the program once it began and were disappointed they did not know about it prior to starting. Dickinson et al. (2011) also found that 'word of mouth' from friends, relatives, or neighbors was an effective method for attendance and uptake. One participant in the Dickinson et al. (2011) study stated, "Through a friend who has done it for years and is a right bossy lady and she said 'you should go' so I thought I'd give it a try." Belza (2007) suggests promoting a program via word of mouth through an elder "champion." The participants in the fall prevention program could be useful as program "champions" since they have already completed the program and have an attachment to it. Testimonials from the participants would be an ideal motivator for other older adults to consider enrolling in a program.

Another related issue to program promotion is the challenge of reaching men to participate in an exercise program (Belza, 2007). There was only one male participant in the current study and he was part of the control group. Program participants in the current study acknowledged the fact that it is difficult to get men to participate. One participant suggested starting a "men's only" program to get them motivated. Once they experience the benefits maybe they would be more open to participating in other programs. Belza (2007) suggested the same idea along with other motivators such as building competition into the program or designing a weight lifting program. It has also been suggested to target men in the advertising for the program by addressing men's sense of athleticism, teamwork, and past participation in sports (Belza, 2007). While we acknowledge that such thinking is

perhaps stereotypical and somewhat gender biased, the lack of research related to how best to engage men in programs such as this highlights the need for more research in this area.

Another program promotion challenge to overcome is the idea that older adults do not like to think of themselves as "old" and may reject programs that are targeting the "older" population (Bunn et al., 2008, Yardley et al., 2006). Thus, it may be better to highlight the social aspect in this case, as Bunn et al. (2008) discovered that people like to interact with others in the same age group. To overcome this issue, one possible solution would be to provide an age range for the program without suggesting the target audience is aging.

Program promotion is an important factor in the success of a fall prevention program. The advertisement sets the stage for program success. If the advertisement does not highlight the core focus of the program then the program may fail before it starts. Important factors to consider when recruiting for future programs are a clear and concise advertisement that includes potential benefits, a desirable time and location, and special considerations for male participants.

CONTROL GROUP VERSUS INTERVENTION GROUP

The intervention and control groups had very different experiences during this study. The control group received education about falls and the possible risks associated with a fall. However, they did not receive the exercise portion, which is where the intervention group gained their confidence and connectedness with other participants. During the control focus group, many participants expressed the desire to have been part of the exercise group. The participants seemed to realize the potential benefits of participation in the fall prevention exercise program. Even though the control group expressed the desire

to have participated in the exercise program many of the participants' stated two classes a week was too great of a commitment. This was in contrast to the intervention group members who looked forward to the classes and were saddened when it came to an end. The intervention group experienced the benefits of the program and wanted other older adults to see the same benefits. One participant had already reached out to other seniors groups with the idea of starting a program to ensure others had the same opportunity.

Even though the two groups had different experiences over the course of the study, the thoughts on falls and fall risk were similar. It became clear that falls was a concern for the participants and many frequently thought about falling throughout the day. There were participants that admitted they never thought about falls until the program began but by the end of the program they knew the risk factors and were thankful for the awareness. One shared view between groups was that the participants were not concerned about falling until they had a fall experience. For one participant the experience was a near miss fall (no fall actually occurred because the individual was able to catch themselves or otherwise avoid a fall). Approximately nine others experienced a fall, with six resulting in injury. This was inevitably followed by fear of falling again. The pre-test balance assessments were eye opening for many as well. The participants assumed the assessments would be easy and were shocked to find out that they lacked the ability to complete the tasks or struggled throughout the tasks. This observation demonstrates older adults' lack of awareness that their balance deteriorated over time and that tasks should be tackled with caution to ensure their safety. Both the intervention and control groups experienced the same shock however only the intervention group was able to confront the issue and learn skills to help overcome the balance deficit.

LIMITATIONS

There were, of course, limitations in this study. One reason why there was no significant improvement observed in the questionnaires and balance assessment may be because the participants were already physically active. Many of the participants engaged in Zumba and shallow water fitness weekly, whereas if the participants were mostly sedentary prior to the program a larger improvement may have been observed. A second reason for the lack of improvement was the length of the intervention program. It is possible that if the fall prevention program ran longer than 10-weeks an improvement would have been observed. A final reason why there may have been no significant improvement in the intervention group was the study had a small sample size and the scales used were designed for larger samples. Therefore, there was not enough statistical power to detect effects. Another limitation was the researcher was not experienced in moderating focus groups. Having an inexperienced moderator may have limited the depth to which some topics were explored. It is beneficial to have an experienced moderator so probes can be used effectively to entice participants to share more information when needed. The researcher did receive training and conducted practice sessions prior to the focus groups therefore the outcome of the focus groups would not have been dramatically affected if an experienced moderator had conducted the sessions instead.

CONCLUSION

Based on the quantitative results it appears that this program was not successful in improving the participants' physical capabilities. There was no significant difference seen in any of the measures tested. However, the qualitative results tell a different story. The

participants were given the opportunity to voice their opinions and concerns and let the researchers know how they felt about the program and fall prevention in general. The older adults welcomed the opportunity to discuss this topic. According to participants, it is not common for older adults to be given a voice in what they think and know about a given issue. There was excitement and determination in the air at the start of the focus group. The older adults were extremely thankful for the opportunity. They took the situation seriously and realized the opportunity that was in front of them.

Based on the information gathered during the focus groups it is clear that the fall prevention program had a very positive impact on the participants. The passion the participants had for this program could be heard in their own words. The excitement that was expressed about having the ability to complete activities of daily living more easily then prior to the program was enough to give this program the validity it needs to continue. Despite the lack of quantitative evidence to support an improvement in balance their perception was that their balance and physical capabilities did improve. Based on the instructor's observations during the course of the program, the participants' physical capabilities certainly improved. For example, at the beginning of the program, many of the participants had difficulty maintaining their balance on a compliant surface when standing with two feet. By the end of the program all participants' were able to maintain their balance during one-leg standing as well as two-leg standing with eyes closed while standing on an unstable surface. As discussed above, the lack of quantitative evidence can be attributed to the use of assessments that were not ideally suited for this already highly functioning group. It may be that the realization of ability is enough to prevent falls in that it gives the participants confidence to complete activities or the knowledge to avoid

activities. The participants' understanding their risk factors and their new found support structures will now make them adapt their activities of daily living and physical activities to be more appropriate to their level of ability.

A fall prevention program is more than planning an effective exercise program for older adults. The older adults are inclined to attend more for the social benefits than for the exercise outcomes. The participants in this study spoke at length about the relationships formed not only with each other but also with the instructors. It is crucial to have instructors that can connect with the participants and listen to their stories, struggles, and triumphs. It encourages the older adults to attend when they know the people running the program are also a shoulder to lean on and an extra ear to listen to their needs and wants.

The confidence and the desire to increase their quality of life was an added bonus for this fall prevention program. With each passing class the participants increased their confidence levels in their exercise ability, which in turn gave them the drive to make lifestyle changes. Seeing themselves make improvement in something as simple as walking across a room helped participants realize what exercising can do for them. It brought about the awareness that leading a healthy life can improve function and ability in activities of daily living. Older adults desire to stay in their own homes for as long as possible to maintain their independence. In order to achieve that goal the participants realized what they had to do and that was to make healthier life choices.

Fall prevention in older adults should be at the forefront of everyone's mind. This is an issue that will eventually affect every individual whether that is personally or through a friend or family member. Once a fall occurs it may be too late for an individual to benefit from a program therefore it is essential to promote prevention instead of rehabilitation.

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APPENDIX A

Introduction

We are going to discuss the exercise program you have been involved in for the last 8 weeks and also your thoughts and feelings surrounding falls and your risk. Before we begin our discussion I just want to let you know that you are being recorded with a voice recorder so I can refer back to the recording when I go to write my report. If you are uncomfortable being recorder I understand and you do not have to stay. Since we are using the recorder try to speak up and let's only have one person talking at a time. Then the recorder can pick up your voice and everyone will be able to get their opinions out there. I will try to give everyone the opportunity to speak. Also, please say exactly what you think. Don't worry about what I think or what the person next to you thinks. We are here to exchange opinions. Your critics and opinions will help with this learning experience and give us the tools we need to make this program the best it can be in the future.

Focus Group Questions

Perceived benefits and falls risk perception

1. To gain comfort and to relax and encourage sharing, start with telling each of their fall experiences.

2. Before you started this program were you worried about falling? Did this effect how you performed your daily activities?
    - Maybe you avoided certain tasks

3. How has your perception about your fall risk changed since you started this program?
    - For better or worse
    - Maybe you didn't think about it before and now you have the awareness
    - Maybe you have gained confidence and will go out more

4. Has your perception of yourself changed since you started the program?
    - Positive or negative
    - Realized you are more capable then you thought
    - Realized you need to be more cautious

5. *Follow-up to the previous question* - What other benefits have you seen since you started the program? Why do you think you benefited from the program? Why do you think you didn't benefit from the program?

Program specific

6. Why did you choose to be a part of the falls prevention program? Why did you choose your specific group (education or education/exercise)?

7. What motivated you to come to the initial information session?

- Was there something in the information session that encouraged you to participate? Or discouraged you to participate?
- What was your initial reaction to the idea of this program?
    - Positive (excited) or negative (Don't have the ability, don't like exercise)
- Has your opinion changed now that you are almost finished the program?

8. What was the most enjoyable part about participating in this program?

9. What was the most challenging part about participating in this program?
    - Was there anything else challenging or negative about the program?
    - Time commitment too much? Too little?
    - What prevented you from attending classes?
    - What would you change about the program?

10. Why would you be involved in a program like this again? Why wouldn't you be involved in a program like this again?

Usefulness of the program to the broader community

11. Do you think a program like this should be offered to others in the community? Why do you think others would or wouldn't be interested in participating?

12. The knowledge we gain from the project will be used to help design a province wide falls prevention program for seniors. Based on your experience as seniors and as participants in this program what advice do you have for the individuals who will be involved in this process? In an ideal world how would we go about preventing falls in seniors in this province?
    - You guys are the experts here. You are seniors and you have already participated in the program. We want to hear your suggestions on how we can improve this program for those to follow.

Extra questions if there is time:

13. What other programs are you involved in?
    a. What do you enjoy about those programs?
    b. What do you dislike about those programs?

14. How did you feel about exercise before you started the program?
    a. How do you feel about it now?
    b. Have you seen any benefits?
    c. Have you experienced any negatives?

15. What did you think of the education session?

Probes

1. Can you explain that further?
2. What made you feel that way?
3. Does anyone else share that opinion?
4. Does anyone else have something different to share?
5. Who had the opposite result?
6. I am getting the impression you had more to add
7. You didn't seem finished with your fault?
8. I do not fully understand what you're saying but most people seem to be agreeing with you. Can you explain that again for my benefit?